RAILROAD GAZETTE

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The Union Station at Pittsburgh.*

THE LOCATION, PREPARATION OF SITE, APPROACHES, ELEVATED TRACKS AND TRAIN SHEDS; BY G. C. CLARK. ASSISTANT ENGINEER OF CONSTRUCTION.

The main line and the Buffalo and Allegheny Valley Division of the Pennsylvania R. R. approached directly from the east on a descending grade of 0.9 ft. per 100 from Seventeenth street, to the west end of the train shed. From the west on the north side of the station, the Pittsburgh, Fort Wayne & Chicago crossing streets at grade, approached on an 18 deg. curve and a level grade. The Duquesne freight track came up Liberty avenue, and joined the Fort Wayne road at the west end of the old station. To the south of the station the Pittsburgh, Cincinnati, Chicago & St. Louis Railroad and the Monongahela Division of the Pennsylvania Railroad approached from the west through the Try street tunnel. The width of the station is determined by the distance between Liberty street and the Grant boulevard and the following facts. There must be one track on the north for the Duquesne freight; there must be two tracks for the Fort Wayne freight trains, which shall not be interfered with by passenger trains standing to load or discharge passengers; there must be at least three tracks for the use of these passenger trains; the P. C. C. & St. L. and Monongahela Division trains must have at least as great a number of tracks to the south of the station. Bringing these tracks together as rapidly as possible after leaving the starting point, we find 175 ft. as the maximum width for the station proper. Since it is necessary to have eight tracks for the use of the Eastern traffic, making the total number of tracks at the train shed 20, and remembering that the farther east we go the higher the boulevard becomes, and the greater the distance the tracks must be kept from it, we see that the farther west the station is kept, the better. In this direction, however, we find Try street tunnel which must be gone through, and Liberty street which is to be crossed overhead. Taking a maximum grade of 1 per cent. from Try street tunnel, and lowering Liberty street as much as possible without damaging the property on that thoroughfare, we find the most western point at which the Panhandle and the Fort Wayne tracks can be brought to the same elevation to be 100 ft. east of the old station and at an elevation of 755.8 ft.

Work of preparing the site for the head house or station proper was begun in March, 1900. The west end of the train shed was taken down and a rough frame building 200 by 80 ft. was erected on the space thus obtained containing waiting room, dining room, restaurant and kitchen, baggage room, ticket offices, mail rooms, women's waiting room, barber shop and toilet rooms. As it was desired to raise this building along with the tracks while it was occupied, the supply pipes, soil pipes, and steam pipes had to be arranged so that no breaks or leaks could occur while this was in progress. In order to provide for this there was introduced in each pipe, between the floor and the sewer a four-jointed U about 7 ft. long. At the beginning this U lay nearly horizontal; but as the floor was raised, carrying one side with it, the pipe was gradually changed so that finally it was a perpendicular pipe (with a short offset) 12 ft. high. This building being completed the traffic was turned into it on the 5th of July, and the razing of the old building begun. As about 70,000 people passed through this building each day, the work had to be done with great care.

The construction work outside of buildings included track raising; retaining walls; face walls; tunnels; bridges and viaduct north of station; train shed.

Had this amount of work been done in the open country, with nothing to contend with except nature, it would not be worth your while to listen to an account of how it was accomplished. But when you consider that the space in which this work was done was not sufficient in an untrammeled condition for the business which was carried on, and that 261 regular passenger trains carrying 100,000 people not only came and went, but were made up in this space daily, and that 90 freight trains daily passed through this yard, we think that you will realize that only a journal of troubles could describe all the makeshifts that were resorted to in order to prosecute the work.

The tracks, platforms, signals, gas and water pipes which supplied cars in the shed were raised 13 ft. at the east end of the station. This raising covered an area of more than 10 acres, and required 100,000 cu. yds. of material to be put under tracks and platforms. The material used was that excavated from the hill south of the station to make room for more tracks. This was slate, rock and clay. The work could no doubt have been done more rapidly with cinder, but now that it is finished, the fill is much more satisfactory than one of cinder could be, as the latter would continue to settle for a long time, and there is always danger of a smouldering fire in cinder used over any great area. During eight hours of the day, the capacity of the yard was taxed to its utmost and nothing could be attempted. As soon after the busy period as one track could be cleared, a large number of men were put on it and it was jacked up about one foot, and blocked in that position with ballast or rock. When this was done, and the track next to it could be cleared, a train of mud cars was placed on this second track and the material shoveled on to the first and rammed under the ties. This same action was repeated by the next shift, except that the train stood on the first track and the second was raised. The platforms were lifted at the same time, being held up by wooden blocking, and the filling kept about 4 ft. below the platforms to allow room for men to work until they were raised to the desired height, when they were filled to a level with the material under the tracks.

Masonry was built directly under one, and in some places two, Fort Wayne tracks while they were being used by freight and passenger trains. Excavation was first made for a short distance under each rail to a depth of about 30 in. below the base of tie, the track being supported meanwhile by blocking under alternate ties; then three Y. P. stringers 8 in. x 14 in. and 24 ft. long were placed under each rail and so arranged that no two joints were less than 6 ft. apart. Twelve in. x 12 in. hemlock caps were then placed under these stringers at intervals of 6 ft., each break in the stringers resting on a cap. Every other cap was then firmly blocked up, and the alternate ones allowed to hang free. Excavation was then continued under these free caps, and 3 ft. on either side, to a depth of about 6 ft. below the base of tie, when a small bent was erected and firmly blocked; taking the weight off the caps which had been resting on blocking. This blocking was then removed and the material excavated to some distance below the sill of the first bent. This distance varied according to the material excavated, and its liability to give way under the pressure. A second set of bents was then erected and the first removed and excavation continued until it became necessary to erect a third and remove the second. When material sufficiently firm for a foundation was reached, the space was filled with concrete to the elevation of the top of foundation, and after it had attained its initial set, a bent was placed on it to support the tracks, and the intermediate bents were removed and excavation and concrete finished.

The concrete having been put in to the base of neat work the stone work was begun. Any timbers in the bents that were more than 2 ft. from the face of the wall were built in, those nearer the face being cut off as the masonry was completed.

In order to make room for the desired number of tracks east of the station it was necessary to excavate very close to the boulevard wall [high above the railroad], which is built at this point on a foundation of hard slate about 10 ft. in thickness. Under this slate are strata of soft shale and a low grade of fire clay. This material is hard enough to stand almost vertical when first excavated, but weathers very badly, and if unprotected would very soon have fallen away enough to destroy the Grant boulevard, besides keeping the tracks near it continually covered. To prevent this, a face wall, much lighter than a retaining wall, was built for a distance of about 1,200 ft., and as high as the bottom of the stratum of hard slate before mentioned. No soft material was allowed to remain back of this wall. Wherever any pockets appeared, as is always the case in rock excavation, they were filled in with solid masonry. Weep holes were left where any water seams appeared in the face of the hill. Fortunately these were necessary in very few places, as the principal water course seemed to be through the stratum of heavy slate and just above the top of the face wall. To properly shed this the coping was given a pitch of about 25 deg. and a coating of cement, with a small quantity of sand, put on it, and carried well back against the face of the rock. This has proven very satisfactory, and very little water comes through the wall, although a great deal runs down over it. It was the large amount of water coming through this layer of slate that determined us to keep the top of our wall below it instead of carrying it to the bottom of the boulevard wall.

The train shed, now being erected, is a single span steel structure 258 ft. wide, 556 ft. long, and 90 ft. high at the center. The arches are arranged in pairs, 9 ft. center to center, and 40.6 ft. between pairs. Each arch is in reality a bow string truss, the bottom cord being under the tracks and imbedded in bituminous concrete to prevent its corroding. The south end of each truss is anchored, while the north end is on rollers to allow for expansion and contraction. There is the usual lantern, running the entire length of the shed at the top, and also lateral lanterns over each pair of arches, and midway between them. There is no glass in the roof proper, all light being admitted through the ends of the shed, and the sides of the lanterns. Being in a vertical position, it is much less likely to be broken and to fall out, and in the location of the Union Station train shed, glass in a horizontal position would require constant cleaning, or it would admit no more light than the slag roof.

CONSTRUCTION AND DESIGN OF STATION, BY MR. J. G. GIAVER, OF D. H. BURNHAM & CO.

The building proper is 137 ft. x 225 ft. long, 14 stories high, including basement and attic, being 210 ft. high from the level of Liberty street to top of cornice. On the west end of the building is the covered cab-stand, 128 ft. 6 in. sq., on the north and south sides there are covered walks 18 ft. 6 in. wide running the entire length of the building. These walks have a roof of glass.

On the east side towards the train shed is a covered platform 60 ft. x 164 ft. In the basement on both sides of the driveway mentioned are the baggage, express and store rooms. The first floor containing the general waiting room, lobbies, dining room, ladies' and gentlemen's waiting rooms and toilet rooms, ticket office, special baggage rooms, barber shop, etc.

The general waiting room has an area of 10,400 sq. ft., being about 67 ft. by 155 ft. This room has a skylight roof over it at a level of third floor, and from this point up the space occupied by the waiting room on the first floor becomes an open air shaft.

The foundations are made entirely of concrete, resting on a gravel bed, which our test borings show to be 50 ft. deep, and going down to the rock. Most of the concrete foundations are made round, tapering off conically to the top. All are proportioned to impose a load of four tons per square foot on the ground and sustain a load of 20 tons per foot on the concrete at bottom of shoe. Specifications for concrete are one cement, two sand and four parts of broken stone.

The round form of piers was adopted on account of being easier to shore and more economical in construction than the square footings. Valcanite cement was used.

The proportions mentioned for concrete may be considered by some engineers somewhat rich, but considering the manner of practical making of concrete, it is a good fault to have a surplus amount of cement and mortar, in order that all voids in the broken stone shall be entirely filled.

The superstructure is of open hearth steel, the column being made of four 8 x 8 angles with web and side plates connected together in the outside and court spandrels by 36 in. deep plate girders. The floor beams and girders are all 15 in. beams, calculated to sustain the actual dead load, besides a live load figured in this case to be 70 lbs. for upper floors and 100 lbs. for the first floor, per square foot of floors.

The roof over waiting room is supported by trusses from column to column and offered the fitting shop some very interesting features in the way of groins for arch penetration. The groins are made of tee irons and are such a shape that they cannot be drawn in two projections. The most interesting and novel feature is the steel construction of the cab-stand. Four pairs of elliptical shaped arches, one pair for each of the four sides of the cab-stands, support the large front arches. The corner pavilions are what they pretend to be: self-supporting brick and terra cotta construction. The inside arch of each of these pairs supports the center dome of the cab-stand, the inside surface of which on the four diagonal corners form a hemisphere. This hemisphere is cut off on the four sides by the above-mentioned trusses, whose form corresponds to the intersection of the vertical plan with the dome on line with this truss. The whole dome is made of ribs and rings, as usual for dome construction, but in this case some of these ribs terminate higher than others, and connect to the three hinged arches. The terra cotta had to have special supports at certain intervals to suit the size of the terra cotta blocks. This makes a very complex network of tees and angles. It is one of the most complicated pieces of structural work that I have ever come in contact with.

The arches are regular three hinged arch construction.

*The new Union station of the Pennsylvania Railroad at Pittsburgh was briefly described in the *Railroad Gazette* of May 11, 1900 (page 301), and a perspective view made from the architect's drawings was shown. A diagram of the tracks of the station, yard and approaches, with a description of the signaling, was given in the issue of March 14, 1902; and the bridges supporting the tracks between the station and the Allegheny River were described May 23 (page 374). The article published herewith is made up of extracts from papers read before the Engineers' Society of Western Pennsylvania, on June 17, 1902.

Both the dome and the arches are simple enough in themselves, from an engineering standpoint, but when the continuity of the dome is broken, as is here the case, a few intricate points come up for consideration. The girders along the extreme east line of the covered trainshed platform are interesting, in that their construction is such that by accident any *one* of the columns supporting this line of girders can be removed from under it without endangering the safety of the roof, which they support.

Where no special ordinances exist specifying loads, it is my custom to figure floor beams of office buildings for a live load of 70 lbs. per square foot, in addition to the actual dead load; for girders 56 lbs., or about 80 per cent., and for columns 42 lbs., or 60 per cent. of the live load for the floor beams per square foot of floor, in addition to the actual dead load, assuming that the entire floor contingent to any given girder will not be loaded to its maximum at any given time, the same argument being used to a higher degree in case of the columns. In proportioning column foundations I consider the actual dead loads, and in addition thereto a live load of 10 pounds per square foot of all floors, all of which figures are subject to modifications in special cases and under special conditions.

The building has seven hydraulic passenger elevators, and a direct hydraulic lift for baggage.

The floor arches between beams are all regular terra cotta construction. All corridor partitions are built of tile while many of the partitions between the offices are of expanded metal and plaster 2 in. thick.

Other novel features in this building are pneumatic tube systems connecting all the floors from second to twelfth inclusive, with receiving and sending stations at each floor, and ice water circulating system furnishing ice water for offices and first floor waiting room.

The cab-stand, with its large outer arches and center dome and the grand approach, has been made the feature of this structure. The entire structure has a modern, monumental, architectural treatment. Brick and terra cotta with a granite base forming the outside finish; the cab-stand being finished almost entirely in terra cotta. The interior walls of vestibules and waiting rooms on first floor are finished in sand-blasted glazed terra cotta, while the ceilings are decorated ornamental plastering. Glazed terra cotta suggested itself and was adopted for the interior walls of the main waiting room and vestibules on account of its cleanliness, as well as general effect.

On the office floors the offices are all located towards the outside of the building, with corridor along the inside court walls. The offices, as well as the corridors, are well ventilated and heated according to the latest and most improved methods.

All corridors have marble floors and base. The two stairs running up through the entire building are made with iron stringers and risers and marble treads. All the offices have maple floors, decorated walls and ceilings, except special offices and committee room, which have oak floors and oak wainscoting, ornamental and decorated plaster ceilings. All doors and interior trim is quarter-sawed oak throughout. The entire first floor is finished in white Italian marble with Belgian black marble forming geometrical patterns.

THE POWER PLANT, BY D. B. KINCH.

The engine and generator equipment comprises four marine type Westinghouse compound engines. These engines are of the standard marine type design. The high pressure cylinder being 17 in. in diameter, the low pressure cylinder 27 in., with a 24 in. stroke. They are equipped with a Right's governor and have a speed of 200 r.p.m. The high pressure cylinder is equipped with a piston valve, double ported, and the low pressure with a slide valve, double ported. The engines are direct connected, to 350 K. W., 220 volts, two phase, alternating current dynamos, of the Westinghouse standard type. One engine driven and one motor driven direct current dynamos each of 37½ K. W. capacity, serve as exciters. These exciters also furnish direct current for a number of small motors, used at various points throughout the building on special apparatus for which alternating current motors are not, as yet, provided by the manufacturers in connection with their apparatus.

Current for the storage battery used in connection with the switch and signal installation is also provided from the exciters. These direct current machines also furnish the primary current for 14 Crocker-Wheeler dynamotors, used exclusively for the telegraphic service. The output of these numerous little machines varies from eight volts on "locals" to 360 volts for duplex and quadruplex service. Battery current for telegraphic purposes is entirely supplanted by the installation of these small sets. Step-up transformers at a ratio of 10 to 1 are installed to furnish lighting and power circuits to outlying districts.

The main pumping engine for hydraulic elevators is of the Riedler type, being fitted with mechanically operated valves. It has duplex single acting outside packed plungers, 9½ in. in diameter and 24 in. stroke, steam cylinders 13 in. and 23 in. in diameter with 24 in. stroke. This pump has a capacity of 1,400 U. S. gallons per minute, against a pressure of 200 lbs. to the square inch, when running at about 96 r.p.m. with a steam pressure at throttle of 150 lbs. The main feature in the design of this pump was to cut down the floor space to the smallest possible area. For this reason the valve gear was put on the outside of the steam cylinders, in order to get the cylinders close together and do away with the necessity of a passage between the gears, which would have materially widened the engine.

The distinctive feature of this pumping engine is the mechanically operated valves. As the pump is single acting, it was necessary to provide a by-pass so as to enable the pump to run without delivering water when the pressure had passed a certain point. The by-pass valve is operated by means of an air cylinder, which also operates an auxiliary throttle; the steam for running the pump being taken through a small by-pass on the side of this throttle, this by-pass having a valve in it, so that the amount of steam fed to the pump can be so adjusted that the pump will not run more than 30 r.p.m. when running on the by-pass. The air cylinder for operating water by-pass valve and throttle is controlled by means of a pilot valve operated by an auxiliary governor, this governor only coming into effect when the speed of the engine has dropped to between 20 and 25 r.p.m. All of the working parts of governor are central, so that friction is entirely eliminated; as auxiliary pumps for elevator service we have installed two simple direct acting Worthington pumps of 750 gallons each. These are also used for the night run. The elevator equipment comprises seven high speed elevators, to travel from train floor to top floor, a distance of 190 ft., and eight direct lift elevators, used for baggage and express service.

For the furnishing of air to the signals and switches as well as for car testing and car cleaning purposes two cross compound vertical Reidler express type compressors are used. Sizes of air cylinders are 14 in. x 24 in. in diameter with 24 in. stroke, driven by a vertical cross compound, non-condensing Corliss steam engine with cylinders 13 in. x 23 in. in diameter and 24 in. stroke. The air cylinders are mounted above the steam cylinders. Both air cylinders and heads are water jacketed. The air suction and delivery valves are placed in the heads; the suction valves being of the semi-rotative type operated by means of a wrist plate, driven from an eccentric in the same manner as the steam gear. An inter-cooler and an after cooler are provided; the inter-cooler having a volume of about six times the volume of the low pressure cylinder, the air being cooled by means of water passing through the tubes. After the air has been delivered from the high pressure cylinder it is passed through the after cooler so as to remove as far as possible all moisture. The air is then delivered to storage tanks located in what is known as the air intake building. This is a separate building of small dimensions directly west of the engine room, and is equipped with storage tanks for air delivery to various points and also with appliances for thoroughly cleansing the air before it is delivered to the suction pipe. A 15 ton electric crane travels the entire length of the engine room, thus assuring valuable aid in case of need.

The boilers are Babcock-Wilcox forged steel, built to carry a working pressure of 200 lbs. There are six boilers in three batteries, each unit 300 h.p., an aggregate of 1,800 h.p. The boilers are equipped complete with Roney stokers and a Hunt coal and ashes conveyor. Hoppers of 50,000 lbs. coal capacity are located over each battery of boilers. A coal crusher at the lower end of the coal hopper is used when lump coal is delivered.

Two Cochrane feed water heaters each of 1,500 h.p. capacity are employed in boiler room, and feed water is delivered to the boilers at a temperature of 200 deg. Fah. All feed water piping to the boilers is of brass and in duplicate.

The chimney is located in the middle of the boiler room and south of the center line. The smoke flues enter chimney on basement level. Suitable dampers under automatic control are installed. The chimney is of the well-known Custodius perforated radial brick, and the actual height without base 240 ft. with a base of 13 ft. 6 in. high. The diameter of chimney is 9 ft. An 18 in. exhaust pipe extends the whole length of the chimney and extends above at top about 6 ft. This pipe will take care of all the steam exhausted during the warmer months. During the colder months the exhausted steam will be employed in heating the office building. The total weight of chimney, including the exhaust pipe, is about 2,600,000 lbs.

The steam piping is all extra heavy, with screwed flanged fittings. Two headers extend along the entire length of boiler room, along the rear of the boilers and about 8 ft. above them. Into each one of these headers, is a main from each boiler. This practically duplicates the piping in the boiler room. The connection to any engine can be cut off from the main steam line without interfering with the supply to other points. The refrigerating and drinking water plant is located at the partition wall between the engine and boiler rooms on the boiler room side, and is of the Carbondale Machine Co.'s construction. The duty performed consists of refrigeration for two refrigerators for kitchen on top floors, containing approximately 1,000 cu. ft., also refrigerating for main restaurant boxes containing about 4,000 cu. ft., the connecting mains aggregating 1,200 ft. The filtering and cooling of the drinking water supply is for about 125 fountains, located in the offices and waiting rooms. The amount of water cooled is about 750 gallons per hour, with a range of 45 deg. Fah., i.e., from 80 deg. on the intake to 35 deg. to delivery mains. The temperature of the water at the drinking fountains is about 41 or 42 deg. The method of circulation used ensures equal temperatures at all points, freedom from air in pipes and a continuous supply at all faucets. The refrigerating machine is of 40 tons capacity, and consists of the generator, analyzer, exchanger, absorber, condenser and brine cooler, with duplicate direct acting single ammonia pumps and duplicate duplex brine circulating pumps. The refrigerant used is fused calcium chloride of 1.250 sp. gr. This substance is circulated through coils in refrigerators, and very low temperatures are possible.

THE WESTINGHOUSE ELECTRO-PNEUMATIC INTERLOCKING; BY J. G. SCHREUDER.

Two vertical type compressors are installed, having each a capacity of 1,500 cu. ft. of free air per minute. The use of compressed air for general purposes is so great that the amount used for the interlocking system is almost negligible in comparison. After leaving the main receiving tanks, that amount of air which supplies the plant is passed through a group of manifold pipes of great radiating capacity, which brings it quickly to normal temperature, in order that the precipitation of moisture due to increased pressure may be effected before entering the service mains. These mains are of 3 in. pipe, one along either side of the plant, and extend throughout its length. These are joined at intervals by cross runs of 2 in. pipe. Valves are distributed in such manner that should a break occur only a small number of switches or signals would be temporarily out of commission.

From these mains, ¾ in. pipes run to each switch and each signal. All conducting wires leave the machine in the form of five conductor cables, and run to each group of switches or signals operated. These are carried in built-up conduits to points of distribution, whence to their terminations they are placed in grooved lumber. The top of the main conduit is usually placed flush with the top of the ties, and the branches several inches lower. The electrical energy is furnished by storage batteries, giving an e.m.f. of 12 volts and having a capacity of 240 ampere hours. There are two sets of these batteries in each of the two large signal towers, one at Twenty-first street and the other at Fifteenth street. One set at each place supplies the necessary current, while the other is being recharged or is standing idle. Each set is made up of six cells in series so that there are in all 24 cells in use on the whole system; the two small towers, at Washington street and Eleventh and Liberty streets, are supplied from the batteries at Fifteenth street.

The average discharge rate at the Twenty-first street plant is 3.3 amperes so that either set can operate it 72 hours without recharging, and as the rate for the other three plants is 4.5 amperes, either set would run them 53 hours. In practice they are shifted every 24 hours and the set just removed from duty is at once recharged. This prolongs the life of the battery, keeps a greater reserve supply of current, and permits of better organization in the matter of attendants. The total output for the system amounts to less than eight amperes at 12 volts, or less than 100 watts, not as much electrical energy as is consumed by two ordinary 16 candle power incandescent lamps. This good and somewhat surprising showing is the result of many years of painstaking investigation and development. Current for charging is taken from the light circuit, through resistance lamps.

In the number of switches operated there are in the Pittsburgh yard nearly as many as in the Boston & Maine Terminal, the Boston Southern Terminal and the St. Louis Terminal combined. Only those switches in the terminal yard proper are counted in each case. The Pittsburgh plant does not operate as many signals in proportion to the number of switches operated as do others, chiefly because the conditions do not call for the various cautionary and special signals ordinarily used. The machine at Fifteenth street has the distinction of operating more switches than is done from any other one point in the world. In all machines, the locking is arranged to permit of a signal being given for every route made possible by the track arrangement. That at Twenty-first street is probably the most complicated of any ever attempted.

Most of the signals govern traffic over many track arrangements, as for instance, signal 22R, which has 52 routes. Further than this, the elaborate scheme of tracks permit of many different routes by which a movement can be made from one given point to another. Thus there is a case in which 12 exist within half the length of the interlocking at Twenty-first street, any one of which may be made in one continuous train movement.

. . . Westbound train movements through the Panhandle tunnel are governed by a slotted signal very simply by the pneumatic tower at Washington street, the track circuit in the tunnel and by the mechanical tower at Fourth avenue. The clearing of this signal requires an unoccupied track through the tunnel together with the co-operation of each of the towers mentioned.

There is special locking between towers, by which it is impossible to clear simultaneously, by adjacent towers, the signals governing train movements in opposite directions over given tracks extending between them. This is done electrically between certain signal levers in the respective towers, which levers may, and in many cases do, control in addition signals for movements other than over the track above mentioned. In order to harmonize the working of this feature it is necessary that it should be under the control of one man. This is done by carrying the circuits involved, through an instrument placed in the tower at Fifteenth street, by the use of which the director is not only kept informed, through annunciators,

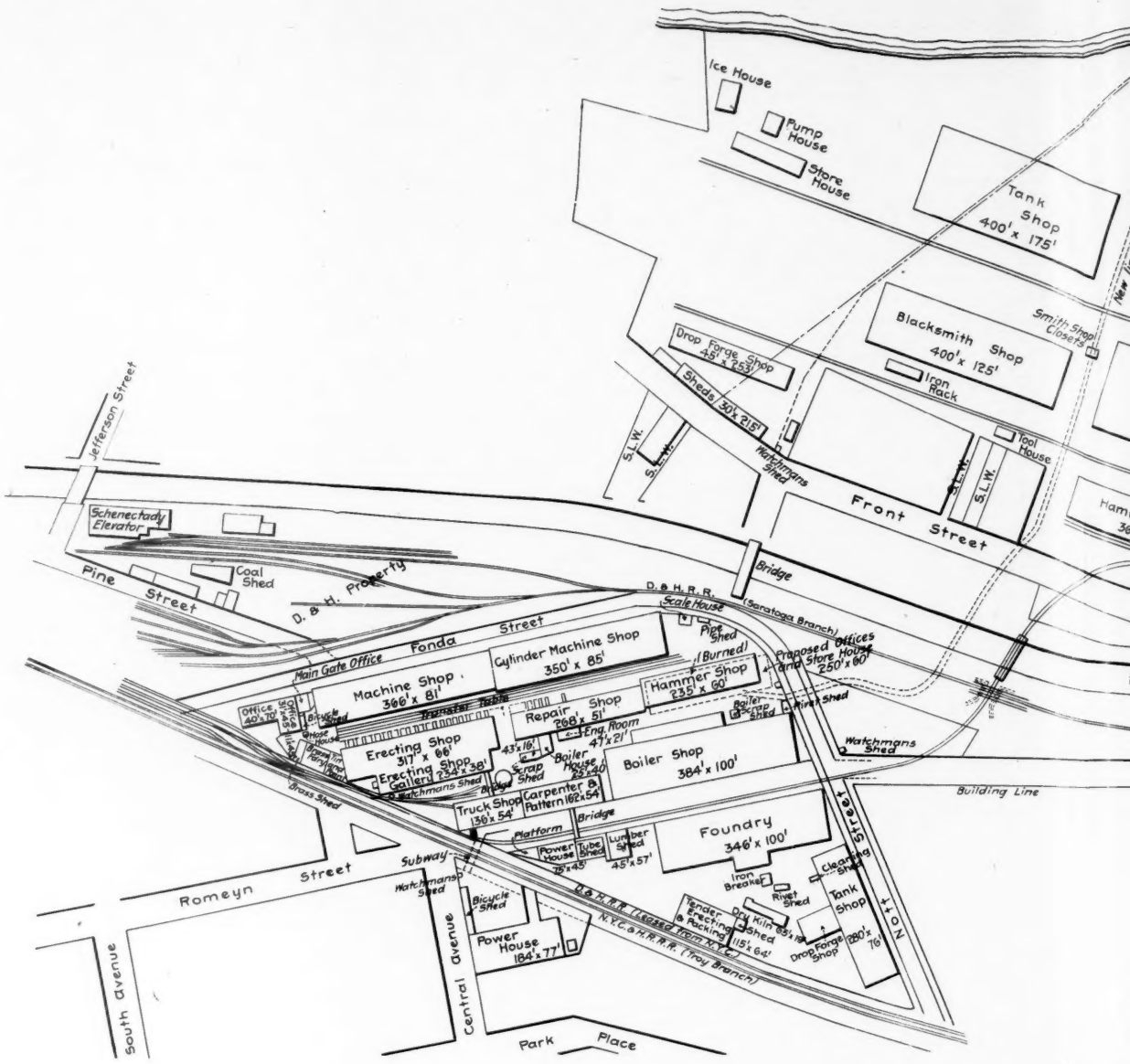


Fig. 1.—General Layout Showing

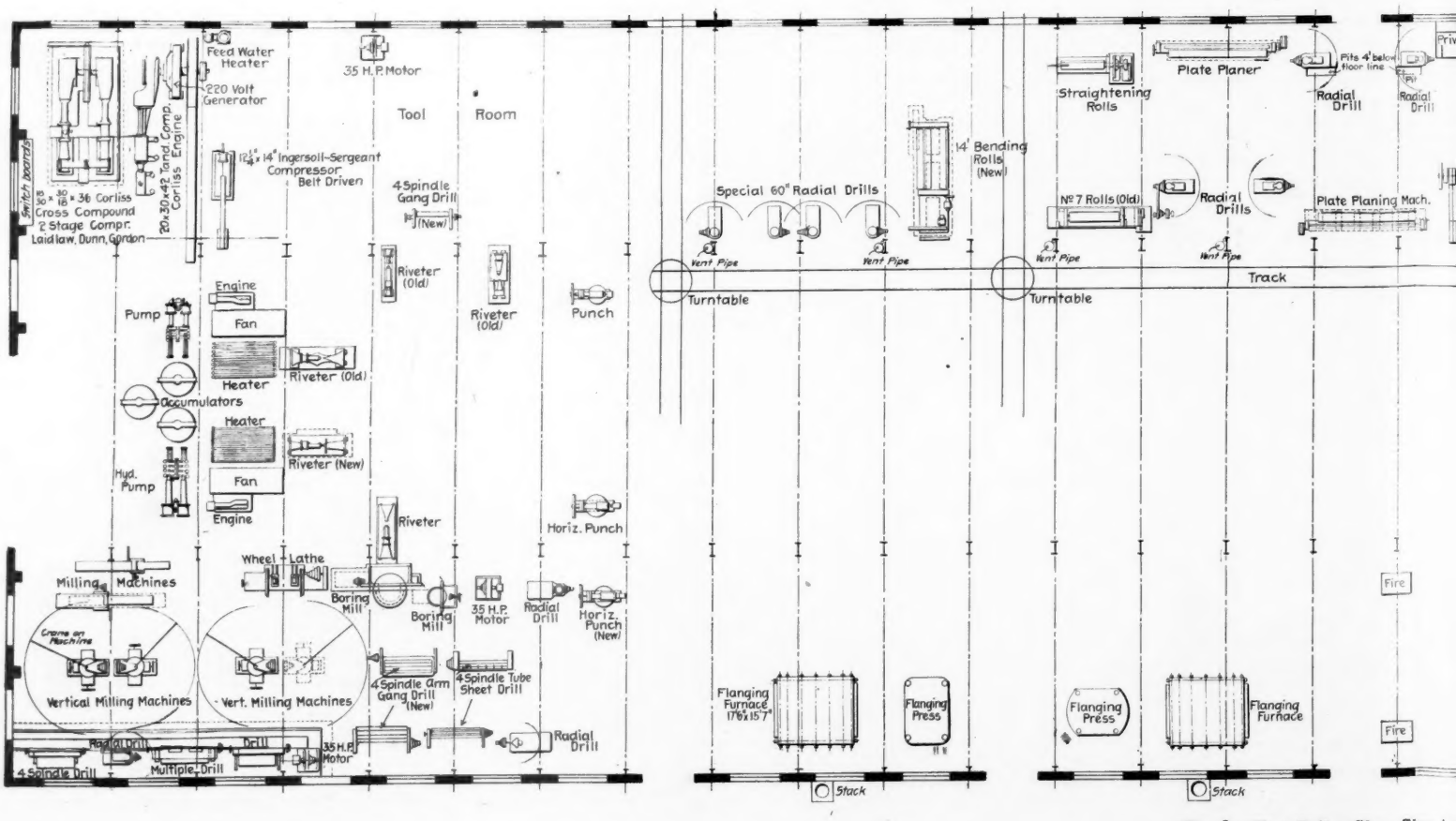
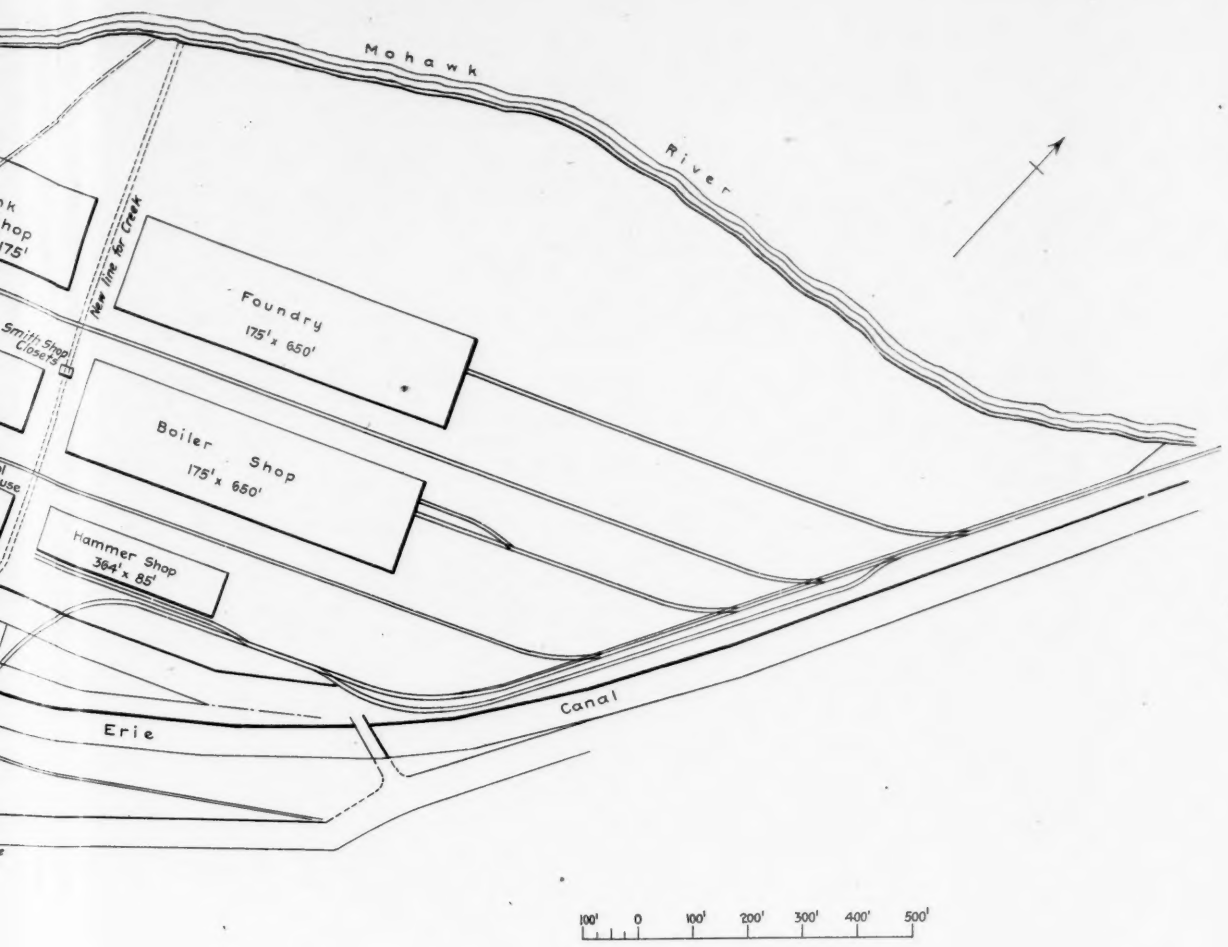
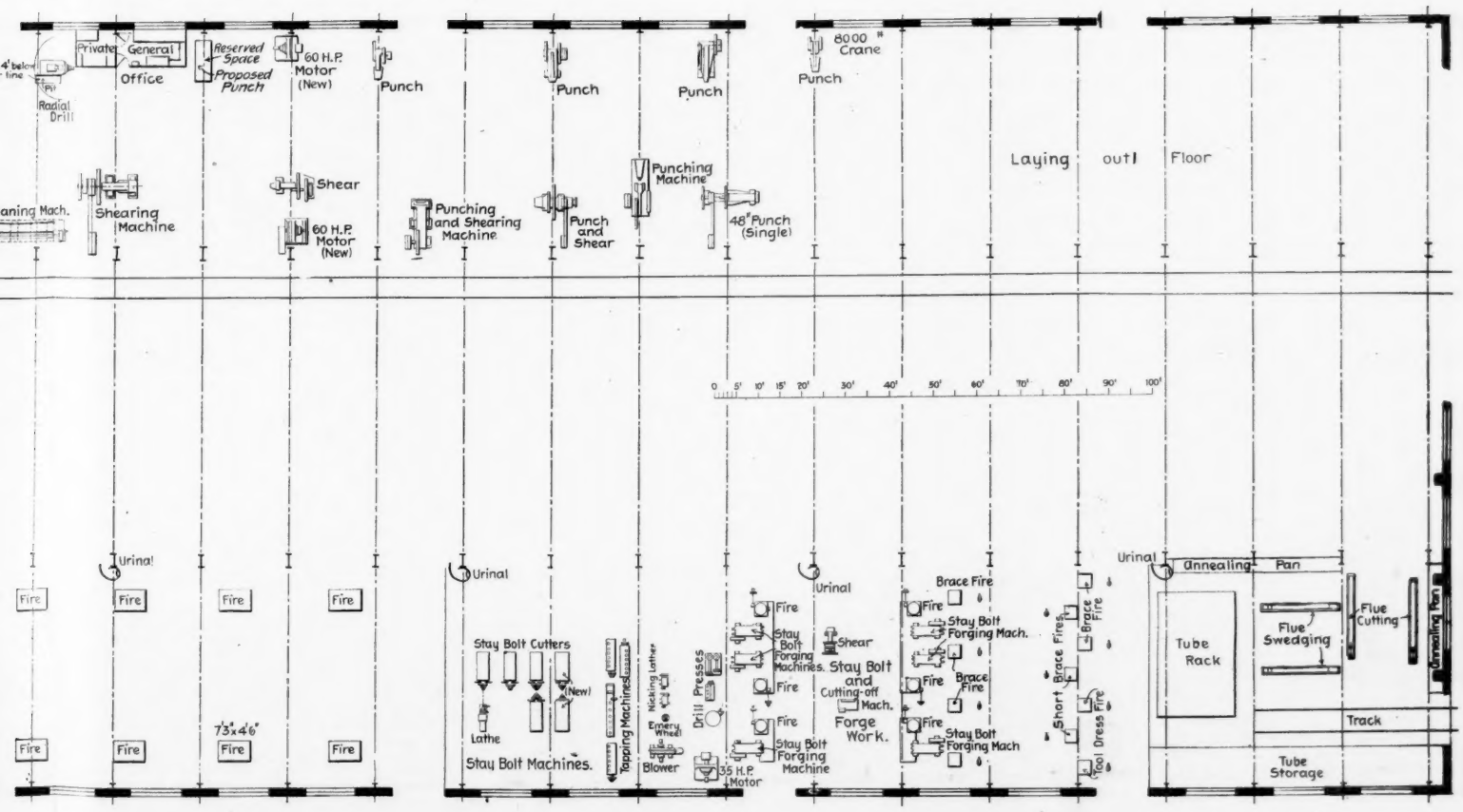


Fig. 3.—New Boiler Shop Showin

IMPROVEMENTS AT THE SCHENECTADY WORKS OF THE AMERI



t Showing **Recent Improvements.**



hop Showing **Location of Tools.**

HE AMERICAN LOCOMOTIVE COMPANY, SCHENECTADY, N. Y.

indicators, etc., as to the direction in which traffic may be moved over any track at that particular instant, but by pushing a button he may change, positively, the direction of traffic over any track between two adjacent interlocking plants. The pushing of this button not only does this, but in addition it records that fact, and at the same time transmits the information to the adjacent tower so affected.

Information concerning trains approaching the terminal from each of the four directions is conveyed to the various towers interested by train describers, the simplest possible means. The sender pushes one of a series of buttons on which is written the information which he desires to send. This act releases and sets in motion a mechanism which closes and opens a circuit a certain number of times until arrested, thereby actuating the electrical mechanism of the receiving instrument or instruments which are on this line, thus causing the finger to point to a button or disc on which is written the same legend as that on the sending button. As additional means of communication there is the usual telegraph, and an extensive telephone system.

The work of installation commenced Sept. 15, 1901, and was completed March 15, 1902, a period of six months, including but little favorable and much unfavorable weather. An item of some interest is that 5¼ miles of detector bar was applied, which required the drilling of 42,000 holes through the web of the rail and related parts. It may be said that the track facilities are in excess of the present requirements, but it is surely a wise policy which builds with an eye to the future.

The following data regarding traffic and lever movements was secured through the courtesy of Mr. A. M. Keppel, Assistant Train Master, in charge of all passenger and freight service using the terminal.

Description per day of 24 hours. (Number of)	15th Street Tower.	21st Street Tower.	Washington St. Tower.	Liberty St. Tower.	Hours Worked by each.
Passenger trains	134	134	70	43	—
Freight trains	97	97	44	53	—
Pass. & Frt. shifting movements	2,513	1,314	664	186	—
Total train movements	2,744	1,545	778	282	—
Lever movements	23,045	10,894	4,257	1,220	—
Telephone calls	2,946	1,082	341	543	—
Train directors	3	3	3	0	8
Asst. train directors..	3	0	0	0	8
Train directors' clerks..	3	0	0	0	8
Levermen	7	6	3	0	8
Levermen & operators..	0	0	0	3	8
Telegraph operators ..	2	2	0	0	12
Signal foremen	¼	¼	¼	¼	—
Signal repairmen	2	2	1½	1½	12
Signal fitters	2	2	—	—	12
Signal lamp men.....	1	1	½	½	12

In addition to the foregoing, Fifteenth street tower has telephone connections with 16 other points. The men called Assistant Train Directors operate these, whose duty it is to gather information respecting the make-up of trains, the probable time of departure from the various train despatchers of the several railroads entering Union Station, inform the Station Master, Baggage Agent, United States Mail transfer clerk, etc., as to the location of trains in the station, and other information that would be of use to them.

The duty of those men marked Train Directors' clerk, is to answer the Train Director's telephone, and collect and distribute information to the towers at Washington street, Liberty street and Twenty-first street, and assist in the manipulation of the trains between these several towers. The Train Directors' clerk has a direct telephone to each of these towers for this purpose.

In comparing the cost of operating the switches and signals by the electro-pneumatic system, with that of the mechanical system, as to the number of levermen required, it will be noted that at the Fifteenth street tower there are seven men. Experience has shown that the ratio is about one in six in favor of the electro-pneumatic, so that this tower would require 42 men if mechanical. The Twenty-first street tower would have 36 instead of six as at present. Washington street tower eight instead of three, and Liberty street tower five instead of three. The latter two towers, on account of their small size, do not maintain the same proportion that the large ones do. However, as a total for all towers we have 19 men for the electro-pneumatic as against 91 men for mechanical system, leaving a balance of 72 men in favor of the former system, whose salary would in a short time amount to the entire cost of the plant. A still further saving is effected in the matter of maintenance, but no definite figures can be given.

The New York Central Tunnel Improvement.

A meeting was held in New York City the other day to further consider the matter of the enlargement of the Park avenue tunnel, and its electric equipment. The New York Central & Hudson River Railroad Company has petitioned to be allowed to widen Park avenue from Fortieth street to Fifty-sixth street. This petition is signed by Mr. Brown, the Third Vice-President, and Mr. Crane, the Treasurer, and was sent to Mr. Cantor, the President of the Borough, on August 30. The change would necessitate closing 10 streets for short distances. The President of the New York Central sent to the President of the Borough a communication concerning this matter, from which the following is quoted:

"It has been the understanding with the Mayor that the city will only co-operate with the railroad company in making the necessary changes upon condition that the railroad company discontinue, as soon as practicable, the use of steam as a motive power through the tunnel in Park avenue. The use of steam as a motive power cannot be actually discontinued until (1) legislative authority has been obtained, and (2) the necessary power-house and equipment are constructed and acquired.

"Anticipating that at the next session of the Legislature the necessary authority to use electric power instead of steam may be given, the company has acquired control of substantially all the private property required to make enlargement of the yards, and for the widening of Park avenue, and is ready to commence this work if the end sought by the petition can be obtained and the necessary municipal action taken.

"It is the present intention of the railroad company to discontinue the use of steam as a motive power for all of its trains through the Park avenue tunnel, and to operate such trains by electricity—probably as far as Croton on the Hudson Division and White Plains on the Harlem Division. The date upon which operation by electricity can be commenced will be determined (the necessary authority being obtained) by the time required for the construction and equipment of power-houses.

"With the same desire the company is ready, if it has the co-operation of the city as prayed for in the petition, to enter into contracts for the power-houses required for operation by electricity, and take other steps for expediting the work as soon as the necessary details can be perfected."

Improvements at the Schenectady Works of the American Locomotive Co.

[WITH AN INSET.]

General Description.—The old shops of the Schenectady Locomotive Works are situated on a triangular piece of ground bounded on two sides by Fonda and Nott streets, and on the third side by the tracks of the Delaware & Hudson and the New York Central Railroad Company.

The rapid development of the last few years has made it necessary for the company to purchase about 65 acres of land to the north of the old shops, and on the other side of the Erie Canal. On this new land they have built, or are now building, new shops, which, when completed, will be one of the most up-to-date in the country.

The new buildings will include a boiler shop, foundry, blacksmith shop, tank shop, hammer shop and drop forge shop, besides several minor structures.

The hammer shop is now in operation. Many of the new machines and tools are now in place in the boiler shop, and are being used. The same is true of the foundry and drop forge shop. The blacksmith shop has been in full operation for some time, and is the oldest of the new set of buildings.

Switching Facilities.—Careful attention has been given the subject of inter-connection between the old and new shops. The method finally adopted can best be seen by reference to Fig. 1. A long lead extends from the old shops, crosses the Erie Canal, and then continues northward along the west bank. From this lead, branch tracks connect with the several new shops. In this manner, material can be quickly and economically conveyed from one set of shops to the other.

Boiler Shop.—The new boiler shop is of brick and stone construction, and steel framing. It is 650 ft. long, and has an extreme width of 175 ft. It is divided into three bays, extending the whole length of the shop. The center bay is 66½ ft. wide, and has a clear height of 38 ft. The east and west bays are each 49 ft. wide, and have a clear height of 24 ft. A cross section of the shop is given by Fig. 2.

A plan of the boiler shop, showing the location of the various machines and tools, is given by Fig. 3. At the west end of the middle bay is the hydraulic riveting tower, in which will be 3 large hydraulic accumulators. These accumulators are to be supplied by 2 steam pumps and one belt driven pump, and will operate at a pressure of 1,600 lbs. per sq. in. These accumulators will furnish the power for two 17 ft., one 12½ ft., one 12 ft., and one 8 ft. vertical hydraulic riveters. The heating and ventilating fans are in front of the accumulators.

The west end of the north bay will contain the power plant, consisting of one 20 in. and 30 in. x 42 in. tandem compound Corliss engine, direct connected to a 220 volt direct current generator, and one 18 in. and 30 in. x 36 in. Corliss cross compound two stage air compressor. There is also a 12¼ in. x 14 in. belt driven compressor of the Ingersoll-Sergeant type. Many of the larger machines throughout the shop will be driven by direct connected motors. The smaller machines such as lathes, drills, etc., have been divided into groups, each group receiving its power from a jack shaft, which is in turn motor driven.

The tool room is not yet laid out, but will be east of the power plant.

The laying out floor for the boiler plates is at the extreme east end of the north bay. From here the plates are carried forward to the punches and shears. About 10 punches and shears of various sizes will be provided. Next in order comes the bending rolls, straightening rolls, radial drill presses, and finally the riveters at the west end. The largest bending roll is 14 ft. long, and is driven by a motor direct connected.

Tube storage racks will be placed at the east end of the south bay, together with flue cutting machines, flue swedging machines and a large annealing pan. A track runs alongside the main tube rack. West of the tube machines will be 14 fires for tool dressing, and brace forging. Next comes the staybolt floor, which will contain 6 staybolt machines, each having a separate fire, 6 Acme staybolt cutters, and a number of smaller machines for tapping and turning. West of these will be 8 fires. The flanging presses are west of the fires. There are 2 such presses; one made by the Rement, Niles Co., and the other a Morgan press. Each of these presses is supplied by a Brooks flanging furnace. The west end of the south bay will contain much miscellaneous machinery such as lathes, milling machines, drills, boring mills, punches, etc.

The central bay of the shop will be used for erection purposes. Four portable hydraulic mud-ring riveters will be provided.

The shop will contain 12 electric traveling cranes. Two of these will traverse the center bay and each have a capacity of 70,000 lbs. Smaller cranes, each of 35,000 lbs. capacity, will serve the side bays, and the riveting tower will have four 50,000 lb. cranes.

The floor of the shop will consist of 5 layers. The top surface will be heavy tongue and groove maple; beneath this will be a layer of 2 in. pine, under this will be 3 in. of sand, under this 12 in. of tar concrete, and on the bottom will be 12 in. of cement concrete. The

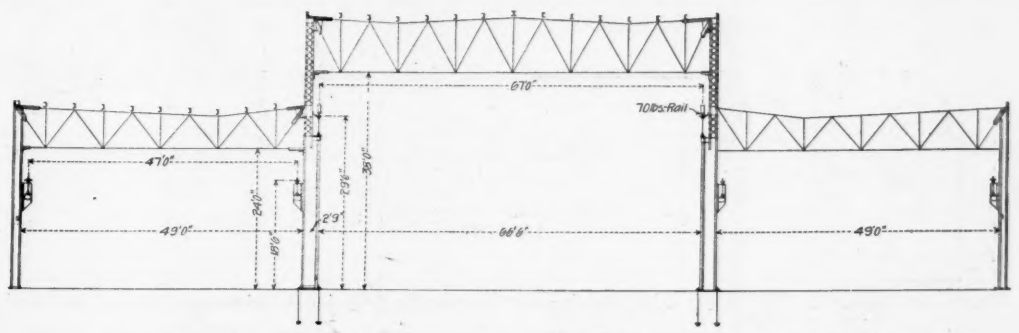


Fig. 2.—New Boiler Shop of Schenectady Locomotive Works—General Design of Steel Framing.

Urinals of a novel design are placed at intervals throughout the length of the center bay. They are made from sheet metal and are in the form of a spiral. They are about 4 ft. high and are flushed by running water.

Foundry.—The foundry is directly north of the boiler shop, and is similar in design.

There are at present 4 cupolas in operation, and room is provided for 2 more. Each cupola is driven by a Root blower direct connected to a motor.

A cylinder mould oven is to be placed in the east end of the south bay, and in the same end of the north bay will be a large core oven. Between these two will be the pit for casting the cylinders.

The foundry will be equipped with the most modern machinery, including a number of moulding machines.

The boiler plant of the new shops will be in the west end of the south bay. There are now in place 3 Franklin water tube boilers equipped with Roney mechanical stokers. Room is provided for 3 more boilers. A high pressure steam line will go from these boilers to the blacksmith shop. Here the line will divide, one branch supplying the engine, and the other branch, with the pressure reduced to 60 lbs., will continue to the drop hammer shop, and supply the hammers therein. There will be 8 auxiliary boilers in this latter shop, one being placed over each of the scrap furnaces to utilize the waste heat. These boilers will connect with the aforementioned steam line.

Hammer Shop.—The hammer shop is between the boiler shop and the Erie Canal, and is 364 ft. long and 85 ft. wide. The shop contains eight 5,000 lbs. steam hammers with separate furnace for each. Each furnace has three doors. Sixteen jib cranes are provided, one for each furnace and one for each hammer. A small room containing 6 shower baths is at the west end of the shop, and is for the use of the workmen.

Scrap Shed.—It is proposed to erect a scrap shed about 150 ft. east of the hammer shop. The plans for this building have not as yet been fully completed, but every facility is to be placed therein for the economical and rapid handling of the scrap iron to the hammer shop.

The shears for cutting the scrap will be mounted on a track running the entire length of the building. Parallel to this track will be a second track, on which the scrap cars will run from the shed to the hammer shop. By this means the cars can be directly loaded from the shears

and pass on to the hammer shop as needed. The shears will be able to cut a 5 in. bar. Cranes, scales, etc., will also be provided.

Blacksmith Shop.—West of the boiler shop is the blacksmith shop, which is 400 ft. long and 125 ft. wide. It is now in full operation. In addition to the usual smaller fires there are also 8 steam hammers, each supplied by its own crane.

The shop is ventilated by 6 exhaust fans in the roof, so designed that the air in the shop is completely changed every five minutes. A similar ventilating system is used in the hammer shop.

Tank Shop.—The foundation is now being built for a tank shop west of the foundry. This building will be 400 ft. long and 175 ft. wide. Herein will be made all tank frames and trucks.

Drop Forge Shop.—The drop forge shop is a wooden structure southwest of the blacksmith shop, and is 253 ft. long and 45 ft. wide.

The east end of the shop is partitioned off and will be used as a die sinking shop. Special attention is to be given this branch of the work. The west end of the shop will contain the drop forging machines, bulldozers, etc.

Other Improvements.—Just north of the old repair shop will be built a six-story store house 250 ft. long and 60 ft. wide. It will occupy the space left vacant by the burning of the old hammer shop. It is proposed to install an overhead trolley system by which the various stores can be distributed to the several buildings. This latter method has not been definitely decided.

The old boiler shop is to be converted into a frame shop. The west end is to be extended, and the room thus provided will be used as a bolt room. The gallery of the erecting shop is now used for this purpose, and when the change is made this gallery will be used for the copper pipe work.

The old tender shop will be used as a rod finishing shop.

The east end of the old foundry will be remodeled and converted into a brass foundry. The old foundry will be used as a shop for sheet iron cabs and tender frames.

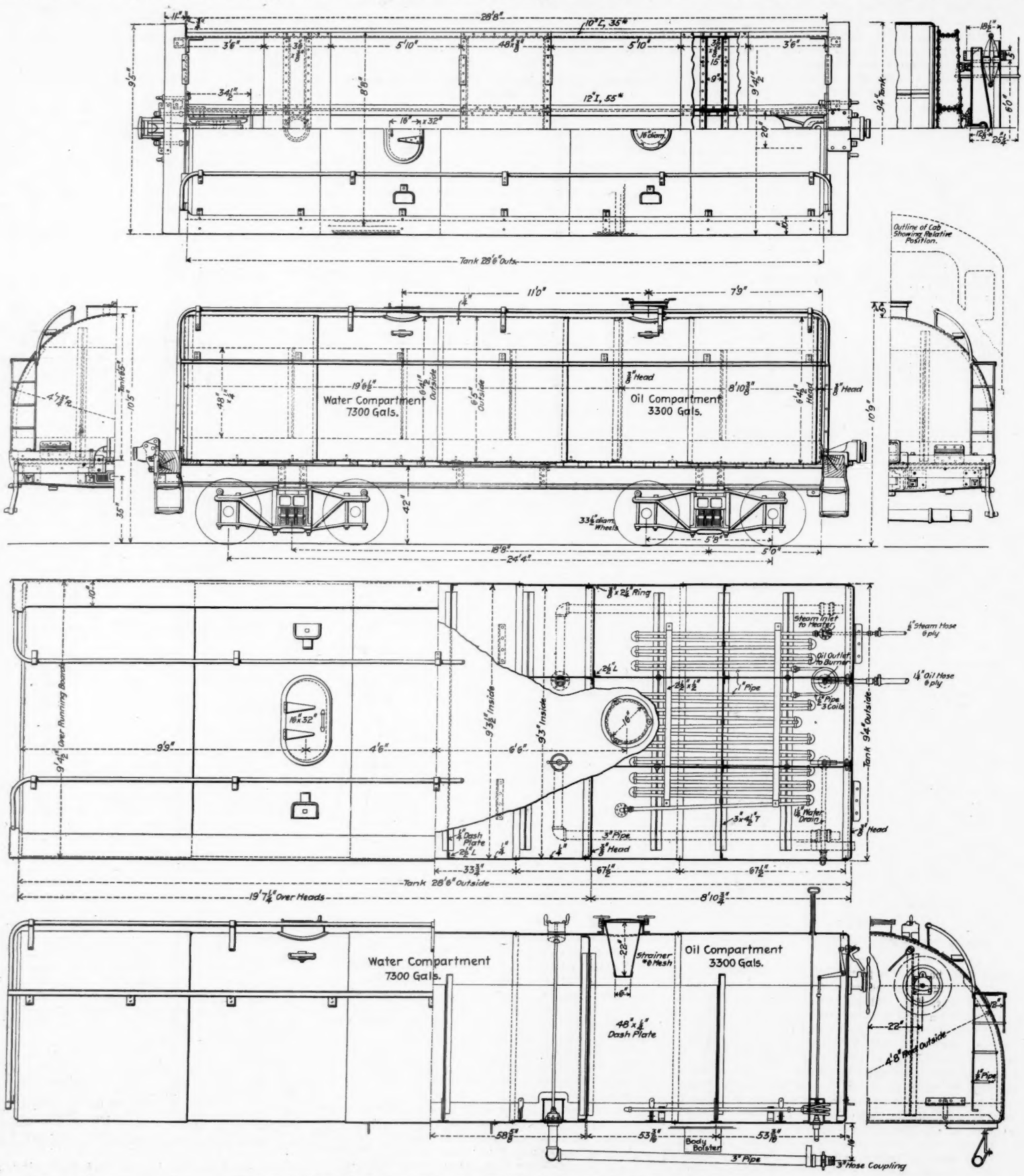
A new engine and dynamo are being placed in the old power house.

Acknowledgments are due Messrs. J. F. Deems, General Superintendent, and L. H. Melville, of the Engineering Department, for information furnished and courtesies extended.

Tender for Oil-Burning Locomotives.

The Southern Pacific is having built some novel tenders for use with its oil-burning locomotives on its California lines. The tank is semi-cylindrical in form and is divided into compartments, for oil and water respectively, the former having a capacity of 3,300 gals. and the latter 7,300 gals. The length of the tank is 28 ft. 6 in. outside, and it is 6 ft. 5 in. high outside. The curvature is struck with a 4 ft. 8 in. radius, the lower part of the sides being straight. The width is 9 ft. 4 in. outside. It is made of ¼-in. steel, the sheets being 69¾ in. wide, with lap seams, single riveted with ⅝-in. rivets, 2-in. centers. A running board of $^{5}/_{16}$-in. material 10-in. wide is placed along each side, with hand holds of 1-in. iron pipe.

The man-hole and cover for the oil compartment is made of cast-iron, the diameter of opening being 16 in. The cover, which is slightly convex in form, is retained in place by three bolts having hand-wheel heads to facilitate removal. The opening is provided with a six-mesh strainer 22 in. deep and tapering to 6 in. diameter at the bottom. The interior of the compartment is provided with lateral and longitudinal dash plates, and at the bottom a steam coil of 1-in. pipe for warming the oil. A small coil of ½-in. pipe, in series with the larger coil, surrounds the oil outlet. The outlet-valve, which discharges into a 1¼-in. pipe, is controlled by a vertical lift-rod attached to a bell-crank, which latter connects to



Semi-Cylindrical Tender and Tank for Oil Burning Locomotives—Southern Pacific.

another bell-crank on the outside of the front head, all as shown by the drawing. It is customary to attach a string to the outside bell-crank or handle, tieing the other end to some point in the cab so that in case of a break-in-two the jerk on this string will, in conjunction with the spiral spring above the valve, operate to close the latter. The vertical rod just beside the valve rod and extending through the top of the tank is a measuring stick.

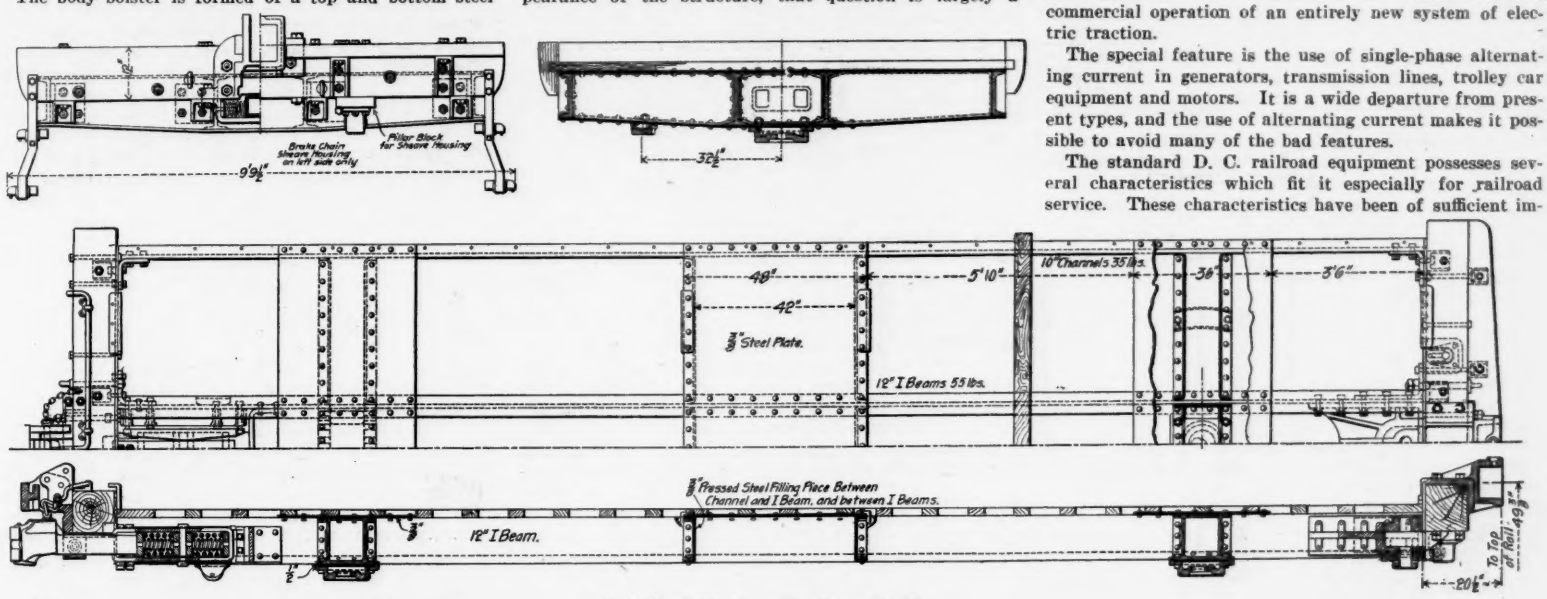
The water compartment has the necessary equipment of dash plates and outlet valves, the latter being surrounded with copper strainers and discharging into 3-in. pipes leading beneath the floor to the front of the tender.

The underframe is steel, the center sills being formed of 12-in. I-beams, 55 lbs. to the foot, and spaced 20 in. between webs. The side sills are 10-in. channels, 35 lbs. per foot, the frame being 8 ft. 8 in. wide over channels. Rigid connection is established between center and side sills by means of the body bolsters and two pressed-steel filling pieces of channel form made of ⅜-in. metal, spaced 21 in. either side of the transverse center line and having a ⅜-in. steel cover plate, 48 in. wide, extending the width of the frame and riveted to the side and center sills and the top flanges of the filling pieces.

The body bolster is formed of a top and bottom steel plate extending the width of the frame, the former being 36 in. wide, with pressed steel filling pieces between the center and side sills, spaced 9 in. between webs; between the center sills is a steel casting of suitable form to which the cast-steel center plate is bolted. The draft rigging, which is a Miner tandem-spring gear, is placed between the center sills. The tank rests on 2 x 4-in. timber strips 9 ft. long, spaced 12 in. centers; the end strips are 10 in. wide.

The trucks are diamond frame, all-metal, 18 ft. 8 in. between centers and having 33½-in. steel-tired wheels. They have Leighton and Howard Steel Company's cast-steel bolsters, carried at each end by a set of three full-elliptic springs resting on a channel-iron spring plank. The brake-beams are inside-hung, the suspension being by means of chains; New York air-brake equipment is used.

The drawings for this tender were furnished us by Mr. H. J. Small, General Superintendent of Motive Power, and he advises us that they have ordered a number built for use with their oil-burning locomotives.



Details of Tender—Southern Pacific.

The Blackwell's Island Bridge Plans.

Below are extracts from the report of the special committee appointed to consider Commissioner Lindenthal's changes in the plans for the Blackwell's Island Bridge, which are disapproved:

"*Whereas*, The Hon. Gustav Lindenthal, Commissioner of Bridges of the City of New York, has submitted to this committee certain changes in the official plans heretofore adopted by the City of New York for the Blackwell's Island Bridge, and,

"*Whereas*, This committee has thereupon and through a special sub-committee appointed for that purpose, consisting of Foster Crowell, E. Platt Stratton, Peter A. Leininger, John Andrews and D. S. Sanborn, instituted a very careful comparison between the proposed revised plan and the adopted plan with reference to their practical bearings upon the public use and convenience, and,

"*Whereas*, The said special committee after careful consideration and study of both the proposed revised plan and the adopted plan, has reported unanimously against the advisability of making any change excepting perhaps in minor details, in the adopted plan; therefore, be it

"*Resolved*, That the Committee of Forty hereby respectfully replies to the Hon. Commissioner of Bridges that the changes he proposes in the Blackwell's Island Bridge, and especially the proposed reduction in width, which he has so courteously submitted to us, are disapproved.

"The plan as adopted calls for a cantilever bridge 120 feet in extreme width, to accommodate four trolley tracks, two elevated railways, two wagon ways and two footways, all of proper width. There was and is nothing unusual or abnormal in the width of structure adopted, the Williamsburgh Bridge, now approaching completion, being 114 feet, and the Manhattan Bridge, which is now being built to afford relief to the Brooklyn Bridge district, being 118 feet. Its general features, as we have been informed by experts whom we have consulted, are in economical accord with the best modern engineering practice for bridges of this type, there being said to be nothing untried or experimental in the design.

"The bridge having thus been so carefully considered and planned to meet the needs of the city and the plan formally approved and adopted together with an estimate of probable cost, and, in addition to this, much of the masonry being already built, this committee is clearly of the opinion that the work should be pushed to completion and that the delay incident to and inseparable from any material changes in the plans should by all means be avoided.

"As the committee is informed, by engineers of high authority, it is questionable whether or not the proposed changes are in themselves desirable from a structural point of view and whether there is any advantage to be gained from them either in convenience or economy, excepting perhaps in matters of detail. As to the appearance of the structure, that question is largely a matter of taste, but our attention has been called to the fact that the upper outline of the proposed revised plan is abruptly broken at span centers, thus introducing an element of ugliness, instead of being continuously curved, as in the adopted plan.

"Taking into consideration the configuration and vast extent of territory that the Blackwell's Island Bridge is to serve, with an area naturally tributary to it greater than the combined areas served by the other three East River bridges, in connection with the fact that Central Park shuts off cross-communication above 59th street clear up to 110th street, thus practically restricting the selection of sites for future additional bridges and tending to concentrate traffic at the present site; and bearing in mind the experience with the Brooklyn Bridge as a developer of traffic to an extent beyond its capacity to serve it, this committee is convinced that the width of the adopted plan, which is 120 feet, is none too wide and may even prove inadequate for the demands of the near future.

"It has been supposed that by making use of the second story greater traffic capacity could be obtained for the proposed revised plan than for the adopted plan, and such statements have been publicly made; but on examination that supposition proves to be erroneous. . . . The proposed revised plan materially reduces the capacity of the bridge, not to speak of the great inconvenience caused to the pedestrians by compelling them to climb up twenty-five feet to the second story and then descend again, which could only be accomplished practically either by stairways, which are an element of danger and should not be tolerated, or by inclines on the approaches that already are designed to have grades of 3.8 feet per 100, which is fully as steep as can be surmounted by the average pedestrian without fatigue, and the inclines would obviously have to be much steeper and would prove very objectionable, besides complicating the approaches, forcing all the pedestrians to travel across the line of vehicular traffic, requiring more width on the approaches than on the main bridge, and involving greater cost. It will thus be seen from the foregoing that it is only by seriously restricting the capacity of the bridge that the proposed reduction in width can be obtained, and an examination of the estimate of comparative cost clearly shows that on a basis of like accommodation the proposed revised plan will be more expensive than the adopted plan.

"There can be no question as to the ultimate need of four trolley tracks (beside the two elevated tracks) because two tracks at least will be required for present existing trolley lines in Queens, besides which the Rapid Transit Commission is now engaged in elaborating plans for interborough communication which must necessarily include the use of the Blackwell's Island Bridge, while the elevated railway tracks, either as such or as trolley lines, will be needed for connection with the Manhattan elevated system.

"One of the most important reasons that have been quoted and urged for the departing from the adopted plan is an alleged saving in cost by the proposed revision; but from such information as is at hand it does not seem to the committee that there is much evidence on which to base such a conclusion, but on the contrary the indications are that for the full capacity that it is possible to give to the proposed revised plan its cost might be even somewhat greater than the cost of the adopted plan with its greater capacity."

Washington, Baltimore and Annapolis Single Phase Railroad.*

BY B. G. LAMME.

The Washington, Baltimore & Annapolis Railway is a new high-speed electric line extending from the suburbs of Washington to Baltimore, a distance of about 31 miles, with a branch from Annapolis Junction to Annapolis, a distance of about 15 miles. The overhead trolley will be used, and schedule speeds of over 40 miles an hour are to be attained. This road is to be the scene of the first commercial operation of an entirely new system of electric traction.

The special feature is the use of single-phase alternating current in generators, transmission lines, trolley car equipment and motors. It is a wide departure from present types, and the use of alternating current makes it possible to avoid many of the bad features.

The standard D. C. railroad equipment possesses several characteristics which fit it especially for railroad service. These characteristics have been of sufficient importance to overbalance many defects in the system. By far the most important characteristic possessed by the D. C. system is found in the type of motor used on the car. The D. C. railroad motor is in all cases a series-wound machine. The series motor is normally a variable field machine and it is this feature which has adapted the motor especially to railroad service.

Polyphase and single-phase induction motors do not possess the variable field feature at all, as they are essentially constant-field machines. The variable field of the series motor makes it automatically adjustable for load and speed conditions. It also enables the series motor to develop large torques without proportionately increased currents. The automatically varying field is accompanied by corresponding variations in the counter e.m.f. of the armature, until the speed can adjust itself to the new field conditions.

Next to the type of motor, the greatest advantage possessed by the D. C. system lies in the use of a single current or circuit, thus permitting the use of one trolley wire. For third rail construction, the use of single current is of even greater importance than in the case of the overhead trolley.

It is seen, therefore, that it is not to the direct current that credit should be given for the great success of the present railroad system, but to the series type of motor and the fact that up to the present time no suitable single-phase A. C. motor has been presented.

Some of the undesirable features of the D. C. railroad system should also be considered. The speed control is inefficient. With series-parallel control, there are two efficient speeds with any given torque, and with multiple control there is but one efficient speed with a given torque. All other speeds are obtained through rheostatic loss, and the greater the reduction from either of the two speeds, series or parallel, the lower will be the efficiency of the equipment. At start, the rheostatic losses are always relatively large, as practically all the voltage of the line is taken up in the rheostat. For heavy railroad service, where operation for long periods at other than full and half speeds may be necessary, the rheostatic loss will be a very serious matter. The controlling devices themselves are also a source of trouble. The best that can be said of the controller is that it is a necessary evil.

Another limitation of the D. C. system is the trolley voltage. The disadvantages of low voltage appear in the extra cost of copper and in the difficulty of collecting current. In heavy railroad work the current to be handled becomes enormous at usual voltages. A 2,400 h.p. electric locomotive, for example, will require between 3,000 and 4,000 amperes at normal rated power and probably

*Some extracts from a paper presented at the 108th meeting of the American Institute of Electrical Engineers, New York, Sept. 26, 1902.

6,000 to 8,000 amperes at times. With the overhead trolley these currents are too heavy to be collected in the ordinary manner, and it is a serious problem with any form of trolley or third rail system which can be used. It is evident that for heavy service, comparable with that of large steam railroads, a much higher voltage than used in our present D. C. system is essential, and the use of higher voltage is destined to come, provided it is not attended by complications which more than overbalance the benefits obtained.

A further disadvantage of the D. C. system is the destructive action known as electrolysis. This may not be of great importance in interurban lines, chiefly because there is nothing to be injured by it. In city work its dangers are well-known, and very expensive constructions are now used to eliminate or minimize its effects.

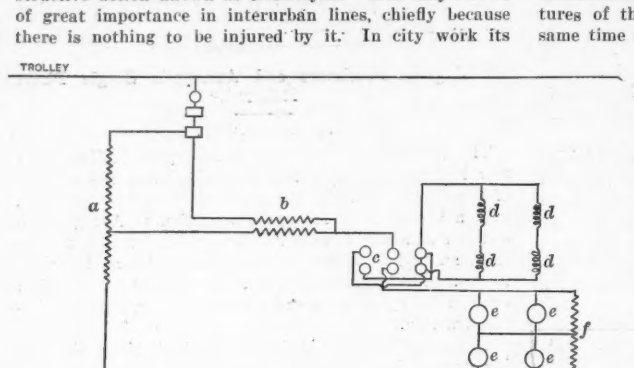


Fig. 1.—a. Auto-Transformer. b. Induction Regulator. c. Reversing Switch. d. Field of Motors. e. Armature of Motors. f. Equalizing Transformers.

From the above statements it is evident that an alternating current railroad system, to equal the D. C., should possess the two principal features of the D. C. system, viz.: A single supply circuit and the variable field motor, and to be an improvement on the D. C. system, the A. C. should avoid some of the more important disadvantages incident to the present D. C. railroad apparatus.

The system must, therefore, be *single-phase*. The importance of using single-phase for railroad work is well known. The difficulties and complications of the trolley construction are such that several A. C. systems have been planned on the basis of single-phase supplied to the car, with converting apparatus on the car to transform to direct current, in order that the standard type of motor may be used. Such plans are attempts to obtain the two most valuable features of the present D. C. system. The polyphase system, used on a few European roads, employs three currents, and therefore does not meet the above requirement.

The motor for the A. C. service should have the variable speed characteristics of the series D. C. motor. The polyphase motor is not suitable, as it is essentially a constant field machine, and does not possess any true variable speed characteristics. Therefore it lacks both of the good features of the D. C. system. A new type of motor must, therefore, be furnished, as none of the alternating current motors in commercial use is adapted for the speed and torque requirements of first-class railroad service. Assuming that such a motor is obtainable for operation on a single-phase circuit, the next step to consider is whether the use of alternating instead of direct current on the car will allow some of the disadvantageous features of the D. C. system to be avoided.

The D. C. limits of voltage are at once removed, as transformers can be used for changing from any desired trolley voltage to any convenient motor voltage. Electrolysis practically disappears. As transformers can be used, variations in supply voltage are easily obtainable. As the motor is assumed to have the characteristics of the direct-current series motor, speed control without rheostatic loss is practicable when voltage control is obtained. This combination, therefore, allows the motor to operate at relatively good efficiency at any speed within the range of voltage obtained. If the voltage be varied over a sufficiently wide range, the speed range may be carried from the maximum desired down to zero, and therefore, down to starting conditions. With such an arrangement no rheostat need be used under any conditions, and the lower the speed at which the motor is operated, the less the power required from the line. The least power is required at start, as the motor is doing no work and there is no rheostatic loss. The losses at start are only these in the motor and transforming apparatus, the total being less than when running at full speed with an equal torque. Such a system, therefore, permits maximum economy in power consumed by motor and control. This economy in control is not possible with the polyphase motor, as this motor is the equivalent of the D. C. shunt motor, with which the rheostatic loss is even greater than with the series motor.

The use of alternating current on the car allows voltage control to be obtained in several ways. There is one method of control, available with alternating current, which avoids the troubles inherent to the D. C. controller. The induction regulator is primarily a transformer, and all wear and tear is confined to the supports which carry the rotor. Therefore the objectionable controller of the standard D. C. system can be eliminated, provided a suitable A. C. motor can be obtained. This ideal type of controller is not applicable to the polyphase railroad motor, in which speed control can be obtained only through rheostatic loss. The polyphase control system is even more complicated than the D. C., as there must be a rheostat for each motor, and two or three circuits in each rheostat. It is thus apparent that by the use of single-phase alternating current with an A. C. motor having the characteristics of the D. C. series motor, the best features of the D. C. system can be obtained, and at the same time many of its disadvantages can be avoided.

This portion of the problem therefore resolves itself into the construction of a single-phase motor having the characteristics of the D. C. series motor. The type of motor which is to be used on the Washington, Baltimore & Annapolis Railway was proposed to the Cleveland Engineering Company, representing the Washington, Baltimore & Annapolis Railway, and after investigation by their engineers, it was adopted. A description of the apparatus to be used on this road will illustrate the system to good advantage.

Single-phase alternating current will be supplied to the car at a frequency of 16⅔ cycles per second, or 2,000 alternations per minute. The current from the overhead trolley wire is normally fed in by one trolley at approximately 1,000 volts.

The alternating current to the car is carried through a main switch or circuit breaker on the car, to an auto-transformer connected between the trolley and the return circuit. At approximately 300 volts from the ground terminal, a lead is brought out from the auto-transformer and passes through the regulator to one terminal of the motors. For starting and controlling the speed, an induction regulator is used with its secondary winding in series with the motors. This secondary circuit of the regulator can be made either to add to, or subtract from the transformer voltage, thus raising or lowering the voltage supplied to the motors. The regulator therefore does double duty. The controller for D. C. motors merely lowers the voltage supplied to the motors but cannot raise it, but an A. C. regulator can be connected for an intermediate voltage, and can either raise or lower the motor voltage. In this way the regulator can be made relatively small, as it handles only the variable element of the voltage and the maximum voltage in the secondary winding is but half of the total variation required.

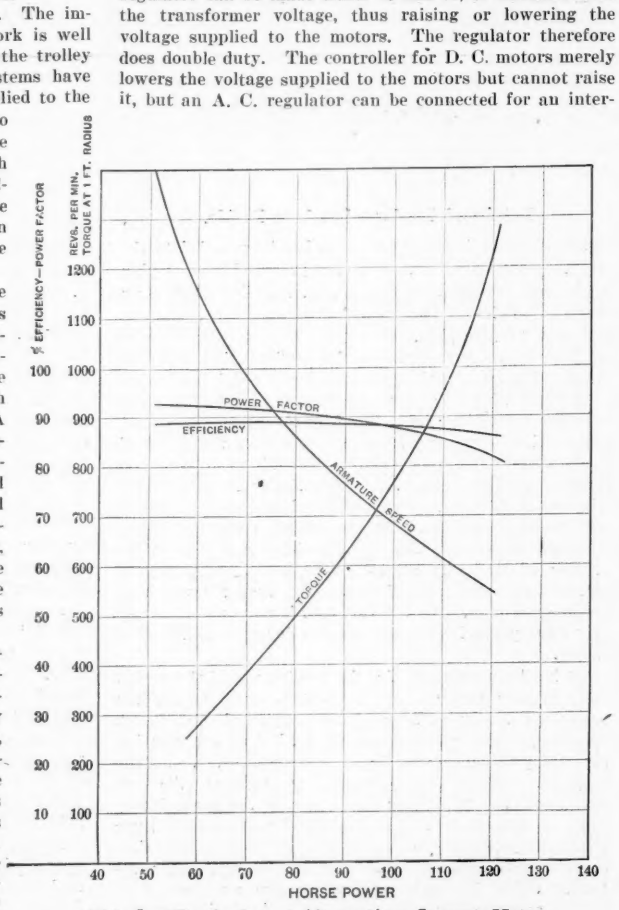


Fig. 2.—Westinghouse Alternating Current Motor. No. 91.—Single-Phase—220 Volts.

In the equipments in question, the range of voltage at the motor is to be varied from approximately 200 volts up to 400 volts or slightly higher. The transformer on the car will supply 315 volts, and the secondary circuit of the regulator will be wound to generate slightly more than 100 volts when turned to the position of its maximum voltage. This voltage of the regulator is about one-fourth of that of the motors at full voltage. The regulator can consequently be made relatively small, in comparison with the motor capacity of the equipment. It has been found unnecessary to use much lower than 200 volts in this installation, as this allows a comparatively low running speed, and approximately 200 volts will be necessary to start with the required torque. The greater part of this voltage is necessary to overcome the e.m.f. of self-induction in the motor windings, which is dependent upon the current through the motor and is independent of the speed of the armature.

There will be four motors of 100 h.p. on each car. The full rated voltage of each motor is approximately 220 volts. The motors are arranged in two pairs, each consisting of two armatures in series, and two fields in series, and the two pairs are connected in parallel. The motors are connected permanently in this manner. Since voltage control is used, there is no necessity for series parallel operation, as with D. C. motors. To ensure equal voltage to the armatures in series, a balancing or equalizing action is obtained by the use of a small auto-transformer connected permanently across the two armatures in series with its middle point connected between them. The fields are arranged in two pairs, with two fields in series and two pairs in multiple. This parallels the fields independently of the armatures, which was formerly the practice with D. C. motors. It was a defective arrangement with such motors, as equal currents in the field did not ensure equal field strengths in the motors, and the armatures connected in parallel, therefore, would be operating in fields of unequal strength, with unequal armature currents as a direct result. With alternating currents in the fields, the case is different. The voltage across the fields is dependent upon the field strengths, and the current supplied to the fields naturally divides itself for equal magnetic strengths. The chief advantage in paralleling the fields and armatures independently is, that one reversing switch may serve for the four motors and one balancing transformer may be used across the two pairs of armatures. The ordinary D. C. arrangement of armatures in series with their own fields can be used, with a greater number of switches and connections.

The general arrangement of the auto-transformer, regulator, motors, etc., is shown in Fig. 1.

An extended series of tests was made with these motors at the Westinghouse shops at East Pittsburgh, both in the testing room and under a car. Fig. 2 shows curves of the speed, torque, efficiency and power factor plotted from data from brake tests.

It should be noted that the efficiency is good, being very nearly equal to that of high-class D. C. motors. The power factor, as shown in these curves, is highest at light loads and decreases with the load. This is due to the fact that the power developed increases approximately in proportion to the current, while the wattless component of the input increases practically as the square of the current. The curve indicates that the average power factor will be very good. The calculations for the W. B. & A. Railway show that the average power factor of the motors will be approximately 86 per cent.

The average efficiency of these equipments will be much higher during starting and accelerating than that of corresponding D. C. equipments, as rheostatic losses are avoided. When running at normal full speed, however, the efficiency will be slightly less than with D. C. This is due to the fact that the A. C. motor efficiency is slightly lower than the D. C., and in addition there are small losses in the transformer and the regulator. The A. C. equipments are somewhat heavier than the D. C., thus requiring some extra power, both in accelerating and at full speed. Therefore, for infrequent stops the D. C. car equipment is more efficient than the A. C., but for frequent stops the A. C. shows the better efficiency. Tests on the East Pittsburgh track verified this conclusion. But the better efficiency of the D. C. equipment with infrequent stops is offset with the A. C. by decreased loss in the trolley wire, by reason of the higher voltage used, and by the elimination of the rotary converter losses. The resultant efficiency for the system will therefore be equal to or better than that of the D. C.

In the W., B. & A. Railway contract the guarantee given by the Westinghouse Electric & Mfg. Co. states that the efficiency of the system shall be equal to that of the D. C. system with rotary converter sub-stations.

There will be an air compressor, driven by a series A. C. motor, on each car, for supplying air to the brakes and for operating the driving mechanism of the controller. The details of this mechanism are not sufficiently near to completion to permit a description of it. The method used will be one which readily allows operation on the multiple-unit system.

The generating station contains some interesting electrical features, but there is no great departure from usual A. C. practice.

It is evident that a good field for this system will be on interurban long-distance lines such as the W. B. & A. Railway. On such railroads, high trolley voltage and the absence of converter sub-stations are very important factors. For heavy railroading also, this system possesses many ideal features. It allows efficient operation of large equipments at practically any speed and any torque, and also avoids the controller troubles which are ever present with large direct current equipments. It also permits the use of high trolley voltage, thus reducing the current to be collected. In this class of service the advantages of this A. C. system are so great that it is possible that heavy railroading will prove to be the special field for it.

For general city work, this system may not find a field for some time to come, as the limitations in the present system are not so great that there will be any urgent necessity for making a change. It is probable that at first it will be applied to new railroads, or in changing over steam roads rather than in replacing existing city equipments. One difficulty with which the new system will have to contend, is due to the fact that the A. C. equipments cannot conveniently operate on

existing D. C. city lines, as is the present practice where interurban lines run into the cities. It will be preferable for it to have its own lines throughout, unless very considerable complication is permitted. When the A. C. system applied to interurban and steam railroads finally becomes of predominant importance, it is probable that the existing D. C. railroads will gradually be changed to A. C. as a matter of convenience in tieing the various lines together.

As was stated above, A. C. equipments cannot conveniently be operated on direct current lines. It does not follow, however, that the motor will not operate on direct current. On the contrary, the motor is a first-class direct current machine, and if supplied with suitable control apparatus and proper voltage it will operate very well on the D. C. lines. This would require that the motors be connected normally in series, as the voltage per motor is low. A complete set of D. C. control apparatus would be needed when the A. C. equipment is to be run on direct current, and considerable switching apparatus would be necessary for disconnecting all the A. C. control system and connecting in the D. C. The complication of such a system may be sufficient to prevent its use, at least for some time to come.

In some cities, very strict laws are in force in regard to the voltage variations in various parts of the track system. The permissible variations are so small in some cases that an enormous amount of copper is used for return conductors; and in some cases special boosters are used in the return circuits to avoid large differences of potential between the various parts of the track system. The object in limiting the conditions in this manner is to avoid troubles from electrolysis. The A. C. system will, of course, remedy this.

In the W. B. & A. Railway, the generators are wound for single-phase. In the case of large power-stations with many feeders, the generators may be wound for three-phase, with single-phase circuits carried out to the transformer sub-station; or three-phase transmission may be used, with the transformers connected in such a manner as will give a fairly well-balanced three-phase load.

PITTSBURGH, Sept. 19, 1902.

The New Westinghouse Foundry at Trafford City, Pa.

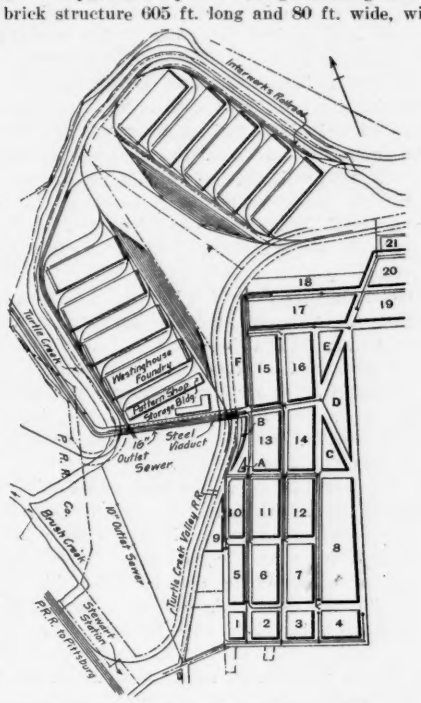
The new industrial center is about 17 miles east of Pittsburgh on the Pennsylvania Railroad, and is to be known as Trafford City. Extensive factory sites have been laid out here to provide for the overflow of the several Westinghouse industries, a number of which have already used up all the available building room at their present locations and are still pressed for space. The first of the Westinghouse Companies to erect buildings in the new city is The Westinghouse Foundry Company, which is at present putting up the extensive and model foundry plant and pattern shop described in this article. This addition is necessitated by the rapidly increasing business of The Westinghouse Machine Company especially in connection with very large steam and gas engines and steam turbines. Before taking up the foundry itself, a short account will be given of Trafford City.

In laying out this city, provision has been made, not only for the factories that are to be erected there, but also for homes and all modern improvements and comforts for the men who are to work in the factories. The latter will be located on a fairly level area between the Pennsylvania Railroad and the residence portion of the city, which will be reached from the railroad station by a steel viaduct 1,100 ft. long. The residence district has been laid out upon hillsides and a generally level plateau, high enough above the factory sites to render it free from smoke and dirt. The city consists of two oblong areas, one of which is about one-half mile by one-fifth mile, and the other one-half mile by one-seventh mile, the two areas meeting in such a way as to form a reversed letter "L," the corner of which is the most northerly part. The town has been laid out into about 800 building lots, each with an average frontage of about 30 ft. and a depth of 100 ft. In addition to this, space has been left for 6 parks. The entire town has been provided with waterworks and sewerage systems, the latter including separate storm water and sanitary sewers. This work, as well as the paving of the streets. was completed before the city was thrown open to settlement. The latter event, which took place on June 7, 1902, recalled in many ways the famous booms of the far West. Many of the intending purchasers of the lots came to the site of the future city a day before the sale was to commence and "squatted" on the ground which they wished to possess.

The new town is connected with Pittsburgh by the Pennsylvania Railroad, over which there are 46 local passenger trains going each way daily and reaching the center of the city in from 25 to 35 minutes. In addition a street railroad line has been built, connecting with the Pittsburgh Railways Company's line at Wilmerding, 2½ miles distant. This street railroad passes over the steel viaduct into Trafford City and forms a loop through the principal streets.

The factory site, in a bend of Turtle Creek, provides room for nine factory buildings, each about 200 ft. by 800 ft. A system of railroad yards and tracks serving this area has been laid out in a very thorough manner, providing a track alongside of each building and transversely through each end. The storage tracks, in connection with this, occupy an area of about 300 ft. by 200 ft. This system of tracks is connected with the main line of the Pennsylvania Railroad by the Turtle Creek Valley branch of the latter. It is, also, to be connected with the towns of Wilmerding and East Pittsburgh, where the works of The Westinghouse Air-Brake Co., the Westinghouse Electric & Manufacturing Co., and the Westinghouse Machine Co., are situated, by an interworks railroad which will be operated by the Westinghouse interests.

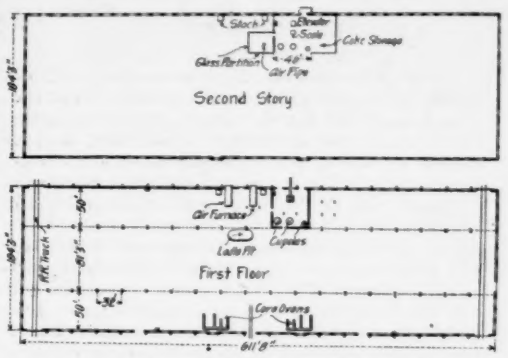
The new foundry and pattern shop of the Westinghouse Foundry Co., which, as stated above, are at present being built, are at the extreme southern portion of the factory site and near the steel viaduct mentioned above. The pattern shop and storage building is a steel and brick structure 605 ft. long and 80 ft. wide, with a



Trafford City—New Westinghouse Shops.

height to the eaves of the roof of 47 ft. The pattern shop occupies 160 ft. at one end of this building. It is divided into two floors, the second floor being suspended from the roof trusses in order that the first story may be entirely free from columns, thus providing ample space for handling the largest patterns. The remaining 447 ft. of the building is to be used for the storage of patterns and has three floors, the two upper floors being supported on steel columns and the entire space being divided by interior fire walls into three separate compartments. The foundations are of concrete and the superstructure of steel and brick. The foundation of the ground floor is made up of 8 in. of concrete into which the floor sleepers are bedded, and on top of these is a layer of 2-in. maple flooring. The upper floors in both the pattern shop and storage building are supported on steel beams and steel girders, and are made up of 3-in. yellow pine flooring covered by one thickness of maple flooring. The roof purlins are steel I-beams spaced 8 ft. center to center, and covered with 3-in. roof sheeting, which is covered with slate.

The foundry building is 611 ft. 8 in. long and 184 ft. 3 in. wide outside of the brick walls, which are 36 ft. high at the eaves and 80 ft. at the peak. As in the case of the pattern shop, the foundations are built of concrete and the superstructure of steel and brick. The foundry is divided transversely into three bays, the center bay being 80 ft. 3 in. wide between centers of columns, runways being provided for traveling cranes of 80-ft. span and 150 tons lifting capacity. The cranes will be electrically driven. The two side bays are each 50 ft. 6 in. wide from center to center of columns and are provided with runways for traveling cranes of 47 ft. 2½ in. span and 50 tons lifting capacity. At one side of the foundry building, runways are provided for yard traveling cranes of 100-ft. span and a lifting capacity

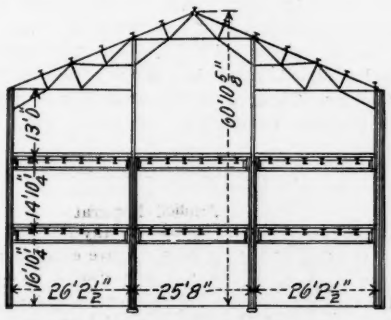


New Westinghouse Foundry—Trafford City.

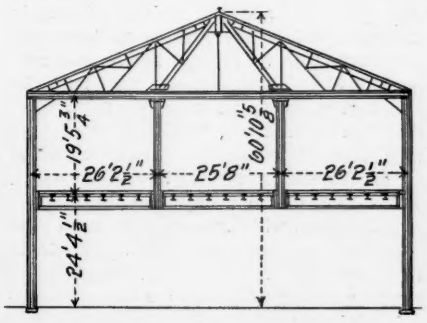
of 75 tons. The I-beam purlins are spaced 8 ft. center and center, and are covered with 3 in. yellow pine roof sheeting. The roof is covered with slate.

At the middle of one of the side bays, where the cupolas are placed, is a charging floor about 50 ft. square, constructed entirely of steel. The melting equipment of the foundry will consist of two air furnaces, each having a capacity of 30 tons, and three cupolas capable of melting 18 tons an hour each. This will enable a casting weighing as much as 100 tons to be easily poured, and the casting can afterwards be lifted out of the sand by one of the 150-ton traveling cranes. The air furnaces will be used for the largest and most important castings, owing to the fact that they yield a superior quality of iron, and the cupolas will be used for the ordinary classes of castings, and particularly small castings. The foundry is expected to produce such castings as those required for the largest size of steam engines now in existence, with provision for possible increase in sizes for the future. Both buildings will have automatic sprinklers for fire protection.

The buildings will be equipped throughout with modern lavatories and conveniences for the comfort of workmen, and will be in every respect up-to-date. They will be heated by hot air, the foundry, pattern shop and pattern storage rooms to have minimum temperature of 50, 60 and 35 deg. Fahrenheit, respectively, in zero weather. Artificial light will be furnished by both arc and incandescent lamps. In order to insure plenty of light during the day, the windows are large and both the foundry building and pattern shop are provided with skylights of large area. The plans for the buildings were prepared under the supervision of the Westinghouse Machine Co. The Security Investment Company, of Pittsburgh, Pa., is the financial agent and general contractor for the entire work, and Messrs. James Stewart & Co., of St. Louis, Mo., and Pittsburgh, Pa., are the managers of construction. The Real Estate Trust Company, of Pittsburgh, Pa., successfully handled the extensive sale of city lots adjoining the new works.



Pattern Storage.



Pattern Shop.

Foreign Railroad Notes.

The Berlin Elevated & Underground Railroad has published statistics of the movement of passengers over the line at different times of day. From 5 to 8 a.m. travel is light, averaging 1,470 passengers per hour between the Zoological Garden and the Stralau Gate. Then it grows till noon: 2,060 per hour from 8 to 10, 2,240 from 10 to 12, and 2,590 from 12 to 2. Then it falls off to 2,490 from 2 to 4, and reaches its maximum shortly after: 3,530 from 4 to 5, 4,060 from 5 to 6, and 4,560 from 6 to 7. From 7 to 10 p.m. the hourly average is 3,625, and from 10 to midnight 1,860.

Formerly in Bavaria it was not uncommon, when a roadmaster had his headquarters at a little station, to appoint his wife station agent. Certain complications followed. As station agent the wife was entitled to travel over the road second-class; as roadmaster, her husband must ride in the third-class cars. Further, in certain matters the roadmaster was compelled to take the orders of the station-agent. But perhaps what ground the husband most was the rule of the road requiring the roadmaster whenever he leaves the station to notify the station agent where he is going and where he may be found at any moment. Certain wives who in most respects are inclined to look down on roadmasters and their wives are said to have envied the latter in this one particular.

The movement for total abstinence among railroad employees in Germany, in which Railroad Director Otto de Terra has taken the leading part, is thought to have made notable progress because the "German Railroaders' Abstinent Society" has adherents to the number of 500. There is a similar society in Switzerland, where perhaps it is more needed; and recently one has been established in France. A report that in Germany the authorities are opposing the movement is officially contradicted.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

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The state railroad administration of Belgium is going to adopt the upwardly-inclined semaphore arm for general use; that is, the use of signals with arms that can be inclined upward, but not downward, will be made the standard practice throughout the state-operated lines. The upward inclination is found to conduce to visibility. The first signals used on these roads were English, and of the regular English design, but on ordering some block signals from Siemens & Halske, their recommendation of the German practice was adopted; and the practice is so well liked that it will be made universal. We mention this fact to American readers because the upward inclination is in use on two prominent roads in this country, and perhaps is being neglected by the rest of us. It seems like a useless innovation, tending to thwart everybody's efforts to secure uniformity; but the officers of the roads where it is in use speak well of it, and their opinion is founded on about 10 years' experience. These two roads—the Erie (west of Salamanca) and the Atchison, Topeka & Santa Fe—employ the upward position for the caution indication. Their block-signalmen give permissive signals, and this is the means of doing it, the semaphore being three-position. In the Belgian signals the upward position means, we suppose, all-clear, that being the common German practice. We are not recommending that the German go-ahead signal be adopted in America; we are not recommending anything; but the facts themselves suggest that the problem of making a satisfactory three-position signal may not have so many insuperable difficulties as is sometimes assumed. Evidently the most insuperable objection to the upward inclination is based wholly on an optical consideration; it looks odd.

But, while we do not make any recommendation concerning the positions of semaphore arms, there is another feature of Belgian practice which probably could be safely recommended to American signal engineers; the height of the semaphore posts. These German-made block signals are only 20 ft. high, except in occasional instances. Why have we settled so universally on 24 ft. and higher? Could not we make a considerable saving in material and at the same time improve the appearance of our semaphores by reducing them in height? Every foot unnecessarily added to the height of a signal requires the addition of bulk and weight to assure stability, and this detracts from neatness of appearance. We make signals high so as to get a sky background; but in many situations it will be found that this object has been made more important than it deserves to be made. A lower elevation would afford a satisfactory background, if we did not insist on seeing the signal such a long time before reaching it. With a proper equipment of distant signals it is not necessary to see signals a mile away. Indeed, this is in some respects undesirable. Seeing signals far off in clear weather, enginemen are more impatient and less disposed to submit to the necessary limitations in time of fog. Many signals, perhaps most, will be found to have, or can be arranged to have, good backgrounds below the sky line, if only the arms and posts are kept clean, so that their color shows as it is intended to show. In connection with this point it is worth while to mention that painting all arms the same color simplifies the engineman's task. There is no good reason for coloring distant arms differently from the home signals. One prominent road has lately adopted the practice of the Pennsylvania Lines West of Pittsburgh, on which all semaphores are yellow. The notch in the end is enough to distinguish the distant signals. The essential function of a signal is performed by parts weighing from five to fifty pounds, and it seems prima facie uneconomical to use as many *hundred* pounds to support these light parts in position.

The Alternating Current for Heavy Railroad Work.

We print on another page some description of the methods and equipment proposed for working the new electric railroad line to be built between Washington and Baltimore (taking in Annapolis). This enterprise has been on foot some years, and has had several vicissitudes, but it seems now to be in a way to be completed. As a business enterprise we have never thought well of it, and still doubt its success—at least for many years. As a technical enterprise it is now taking on very great interest, for it is to be a step in the experimental demonstration of what may be the next great movement forward in the art of electric traction. In this light it is of unusual importance to railroad men. It suggests a way in which, perhaps, the field of heavy, long distance railroad work may be invaded by electricity; therefore, the engineering department officers, and the transportation officers who have engineering knowledge and taste will do well to read the paper with care, for it seems to point the way.

In the past few years we have repeatedly said in print, and in oral discussion that, *in the present state of the electric art*, heavy, long distance business, handled in large and infrequent units, can be done cheaper by steam than by electricity. We think that the really well-informed engineers agree in this opinion. but the words italicized must be read carefully. The state of the electric art will not be its present state five or ten years from now. Nothing in the whole field of engineering is more certain than this. The uses of electricity as a means of transmitting and applying energy will be multiplied in ways that the most daring imagination does not foresee.

The officer responsible for the security of investments in steam railroads is taking considerable risk if he does not keep a sharp eye on the sure and steady advance in the knowledge of the uses of electricity.

Mr. Lamme points out in the paper which is the text of these remarks, that the single-phase alternating current, used from the generator to the motor, has advantages which seem to indicate that it will open up a new and broad field for electric traction. He says that the Washington, Baltimore & Annapolis Railway will be the scene of the first commercial operation of this new system.

This is not a new thought, nor is it at all certain that this railroad will be the first to go into commercial operation. The reader will not have forgotten the determined and even brilliant fight made by Ganz & Company, of Budapest, to get the job of electrifying the Metropolitan District Railway of London. It was proposed to use the system which has been some time in use on a short line in Budapest, and which has been installed on a line of 20 miles, or so, near Lake Como, which, we suppose, must have been something like a year in operation. This is an alternating current system. It is a three-phase system to be sure, and so far Mr. Lamme may be strictly correct in claiming priority for the Washington-Baltimore single-phase installation.

A couple of years ago, or thereabouts, Mr. Bion J. Arnold laid out a scheme for the Lansing, St. John & St. Louis Railway in Michigan. This road is now building, and a part of it is in operation with steam locomotives. It is probable, we suppose, that it will be working by electricity before the Washington-Baltimore line is in operation. This also is to be worked by alternating current. So much for the question of priority in actual working.

It would be hard to assign priority of idea. Electrical engineers have long studied and debated the advantages and disadvantages of the alternating current for traction, and have been aware of its possibilities and difficulties. Experimental apparatus was made and tried on a considerable scale at least eight years ago. There has been an impression that the manufacturing companies have rather discouraged the development of the use of the alternating system for business reasons; for, in recent years, they have had about all that they could do in installing apparatus already thoroughly tried out. It is denied, however, by officers of some of the big companies that this has been their policy.

However this may be, a few advocates of this system have been pretty resolute. Last summer at the Great Barrington meeting of the Institute of Electric Engineers, President Steinmetz said "Mr. Arnold was the strongest advocate of the alternating current railway last year at Buffalo," and Mr. Arnold said "A study of the railway question from an engineering standpoint partially convinced me of the ultimate abandonment of the direct current motor for heavy and long distance service. . . . I have constructed twenty miles of road for this system, together with the necessary trucks and motor equipments. I firmly believe that the alternating current motor will finally prevail for heavy railway work. . . . The principles underlying the system I advocate . . . are, first, a single-phase or multiphase motor. . . . I am building my line for 15,000 volts. A static transformer will be carried upon each car, and the pressure reduced from the line voltage to the voltage of the motor, which, in the case under construction, is designed for 200 volts. Where it is unnecessary to utilize so high a line pressure the motor may be designed for the working voltage and the current fed directly from the working conductor into the motor, thus eliminating the static transformer." At Paris, in August, 1902, in the joint meeting of the American Institute and the Paris Institute, Mr. Arnold said: "I believe that the alternating current will ultimately predominate in railway work. I believe that we shall soon eliminate the sub-station, the rotary converter, and possibly the static transformer at the power station. We shall, at least, eliminate the sub-stations." A year later, at the Buffalo meeting of the Institute, he said: "I am now in favor of the alternating motor on railway trains, notwithstanding the fact that it does not seem to have many friends here to-day. . . . For slow speed railway systems, such as we are operating in our cities to-day, I do not think that there is anything that can equal the direct current . . . but when we come into heavy railway work where we want to start a heavy train from one terminus and run it through to another terminus at high speed, with few stops, it seems to me the alternating current is the ideal thing for it. I am looking for the manufacturing engineers of this country to solve that problem."

These sentences are quoted because they are convenient to hand and because they illustrate the point that the idea of railroad working by alternating current has had stout advocates for some years, and that even the machinery for such working has been devised by more than one electrical engineer. So much for priority.

But, after all, priority is not very important. The main thing is to keep our eyes and our minds open to the fact that the intelligent, courageous and enterprising gentlemen who are developing the art of electric traction are not sleeping, and to the further fact that in their young art they have possibilities of advances and of changes which cannot in the nature of things exist in steam railroading. Steam railroading is about five times as old as electric railroading. The probability of rapid and great changes is perhaps something five times as great in the younger art.

Annual Reports.

Atchison, Topeka & Santa Fe.—The seventh annual report since the reorganization is issued in very complete form, as usual. The average mileage operated was 7,855, an increase of 48 miles, divided between the main line and the Gulf, Colorado & Santa Fe. New lines in eastern Oklahoma which aggregate about 250 miles have been authorized by the directors and have been located, passing through an excellent agricultural region and forming part of a new, low-grade, through line to the south. It is pointed out, however, that the number of new lines built, building and projected in Oklahoma is so great as to occasion serious danger that the territory will not be able to support them all. Control has also been extended over the Pecos Valley Lines, the California Eastern, the Santa Fe, Prescott & Phœnix and Kansas Southwestern roads by purchase of securities, the interest in

the latter case being shared with the St. Louis & San Francisco.

Gross earnings were $59,135,085, an increase of $4,660,263; operating expenses were $33,909,269, an increase of $1,646,323, and net earnings $25,225,817, an increase of $3,013,940. As a result of this large increase in earnings rather than of decrease in expenditure, the percentage of working expenses to earnings was 57.34 as against 59.23 in 1901. The total maintenance charges for road and structures, and for equipment were $14,006,418, which is at the rate of $1,783 per mile, as against a total last year of $12,755,790, or $1,633.8 per mile. All of the increase, however, and considerably more than half of the total expenditure was applied to equipment as shown below, and maintenance of way and structures decreased.

	1902.	1901.	Increase or Decrease.
Maintenance of way and structures	$6,141,466	$6,352,244	—210,778
Per mile	781.8	813.6	—31.8
Maintenance of equipment	7,864,951	6,403,546	+1,461,405
Per mile	1,001.2	820.2	+18.1

The charge in operating expenses for maintenance of equipment amounted to $3,156 per locomotive, $829 per passenger car and $86 per freight car. In addition to this, equipment was purchased and charged to capital account to the amount of $7,159,155, and a considerable number of locomotives and cars are contracted for, but had not been delivered at the end of the fiscal year. The report states that hereafter it will not be necessary to burden operating expenses with such heavy renewal charges.

Although the amount spent on maintenance of road and structures showed a decrease and was, in fact, less than for any year since 1896, the condition of track, buildings and appurtenances is said to be, and no doubt is, better than at any time during the company's history. The Atchison early began appropriating large sums out of earnings to increase the efficiency of the system, as is shown from the following table compiled from the annual reports.

Maintenance of Road and Structure, Per Mile of Road.

	1897	1898	1899	1900	1901	Av. per Year.
*Atchison	$975	$1,194	$1,091	$865.5	$824	989.9
Missouri Pac.	650.6	736.2	709.9	808.9	900.6	761.2
St. Louis & San Francisco	558.2	588.3	581.8	524.3	687.9	588.1

Totals—

Atchison	$4,949.5
Missouri Pacific	3,806.2
St. Louis & San Francisco	2,940.5

*Average at close of year. Others, total at close of year.

The conditions of the Atchison are not such as to favor heavy freight train loads, but in the last year there was a gain of 2 per cent., up to 247.5 tons. The load per loaded car gained 8.57 per cent., to 13.68 tons, and the freight train-mile revenue rose from $2.44 to $2.53, or 3.69 per cent.

The increase in gross earnings occurred in spite of failure of the corn crop, a partial failure of the cotton crop, and large falling off in citrus fruits, and largely increased expenses caused by advance in wages and material. Average rates on both freight and passengers were also lower, but miscellaneous tonnage and passenger traffic showed a large increase. At present the prospect for the year is better than a year ago for all crops except wheat, which is somewhat below the average. Both gross and net earnings have shown striking gains each year since 1897. Gross in 1897 were $30,621,230 as against the current $59,135,805, so that they may be said, roughly, to have doubled in five years. The surplus in the same period has risen to $15,564,527 from a deficit of $87,934. The gross earnings per mile of road worked have increased steadily year by year from $4,752 in 1897 to $7,528 in 1902.

Capital changes during the year included the expenditure of $20,542,108, and the retirement of $250,000 equipment bonds, extinguishing the equipment obligations. The expenditure includes the acquisition of the securities of other railroads, previously mentioned, to the amount of $6,768,636; new equipment to the amount of $7,226,773, in addition to the rolling stock purchased with the replacement fund; new fuel lands, which cost $1,256,577, and miscellaneous expenditure on improvements of a permanent character, which make up the total. At a meeting of the directors last January an issue of $30,000,000 four per cent. serial debentures was authorized, divided into 12 series of $2,500,000 each, of which one series will mature annually beginning with Feb. 1, 1903. This arrangement was made because it was believed that the maturing obligation could be met annually from the surplus net income after the payment of dividends on the preferred and common stock, and because it was thought unwise at the present time to make a permanent increase of the funded debt and fixed charges. It would appear from the figures given that the management has taken a conservative view of its ability to meet the new obligation, since the surplus for the current year was equivalent to 5 per cent. on the preferred stock, and over 9½ per cent. on the common stock outstanding. The dividend paid on the common stock was 4 per cent., which leaves a current surplus of $5,777,619.

The purchase of fuel lands referred to in the capital expenditure of the year is an interesting movement. The directors bought the entire capital stock of the Petroleum Development Co. of California, controlling about 1,500 acres in the Kern River petroleum fields, of which about 500 acres are "proven" oil-bearing land, estimated by experts to contain enough oil to supply fuel for the 831 miles of lines between San Francisco and Seligman, Ariz., as well as floating equipment in San Francisco Bay for about 100 years, at the present rate of consumption, and have every reason to suppose that the remaining 1,000 acres will also be oil bearing.

The new work mentioned, besides the 250 miles in eastern Oklahoma previously referred to, includes extensions northward, of the Gulf, Beaumont & Kansas City and the Gulf, Beaumont & Great Northern lines, passing through pine forests in Texas. Two short branches of the Santa Fe, Prescott & Phœnix are also building to mining districts. The work on the new San Francisco terminals is progressing satisfactorily. Statistics of operation follow:

Earnings.	1902.	1901.
Freight	$41,815,607	$39,052,557
Passenger	13,439,384	11,678,017
Miscellaneous	3,880,094	3,744,248
Gross earnings	$59,135,085	$54,474,822
Expenses.		
Maintenance of road and structures	$6,141,466	$6,352,244
Maintenance of equipment	7,864,951	6,403,546
Conducting transportation	18,442,437	17,243,303
General expenses	1,460,413	1,363,851
Special betterment account		900,000
Total operating expenses	33,909,268	32,262,945
Net earnings	25,225,817	22,211,877
Add income from other sources	1,140,859	332,557
Fixed charges	8,438,985	7,830,811
Taxes, rentals, etc.	2,363,164	2,239,095
Net income	15,564,527	12,474,529
Dividends paid	9,786,910	7,238,022
Balance	5,777,617	5,236,507

The Atlantic Coast Line Purchase of the Control of the Louisville & Nashville.

Another step in the consolidation of railroad interests was taken this week, when arrangements were made for transferring to the Atlantic Coast Line Company ownership of a majority interest in the outstanding $60,000,000 capital stock for the Louisville & Nashville, one of the oldest and most famous roads of the country. J. P. Morgan & Co., who have had the control of the majority of Louisville & Nashville shares, or $30,600,000 par value, since last April, have agreed to turn over this majority interest to the interests controlling the Atlantic Coast Line Company. No offer to buy any of the minority stock is made and apparently the Louisville & Nashville Railroad will continue to be worked much as it has been in the past, probably under its own organization, with such changes in the personnel of its directorate as may be agreeable to the Atlantic Coast Line interests.

While the terms under which the Atlantic Coast Line interests come into the control had not been officially announced at this writing it is generally understood that for the 306,000 shares, representing an absolute majority of the outstanding Louisville & Nashville Railroad stock, the Atlantic Coast Line interests agree to give $35,000,000 in new 4 per cent. bonds; $5,000,000 in Atlantic Coast Line Railroad common stock, which is now quoted at about 180 in the market, and in addition $10,000,000 in cash. This financing is done through the Atlantic Coast Line Company of Connecticut, a security holding corporation with $10,000,000 capital stock outstanding and which holds in its treasury a majority of the outstanding capital stock of the Atlantic Coast Line Railroad, which is the operating company. This price represents about $165 per share paid for the controlling interest.

In thus definitely fixing the future of the Louisville & Nashville one of the remarkable episodes of speculation in Wall Street has been closed. The beginning of it may be placed about January, when stock market adventurers with large capital at their disposal undertook to buy heavily of Louisville & Nashville, and by April had succeeded in acquiring contracts of sale for approximately half of the then outstanding capital stock of $55,000,000. It is not known that they had any plan for the disposal of these shares other than to re-sell them on the market. At a critical moment in these operations the directors of the Louisville & Nashville decided to sell $5,000,000 capital stock held in the treasury to provide funds needed to acquire a new line and to build new mileage which would give the company a direct route from Atlanta to Cincinnati and for general improvement purposes. The directors decided that it would be most advantageous to the company to dispose of these shares by sale in the open market at the then prevailing high prices which had been stimulated by the heavy purchases of the speculative clique. This was a perfectly legitimate and proper action by the directors, who had only the interests of the company in mind. Under their direction the Chairman of the Board gave an order to sell this $5,000,000 additional stock for the benefit of the company, no public announcement of this fact of course being made. This heavy and unexpected offering of stock threatened to force down the price of the stock against the interest of the speculators who were compelled to take these offerings for their own protection. They then found, however, that they held more than a majority of the then outstanding capital stock of the company and that much more stock had been sold to them than could be delivered by the sellers. A "corner" in the stock had been created. The $5,000,000 shares sold under the order of the Louisville & Nashville directors could not be delivered by the company or its agents under the contracts of sale, owing to a rule of the New York Stock Exchange requiring action by its constituted authorities, before additional issues of securities could be recognized as deliverable under contracts made between brokers on the stock exchange. With contracts made for the sale of new stock, whose issue had been authorized by the directors, and the actual shares being undeliverable, it was in the power of the speculative purchasers of the stock to force enormous losses upon those who in good faith had executed orders for the sale of stock, which they could not deliver. To prevent a serious disturbance in the financial markets J. P. Morgan & Co. agreed to take over from the syndicate all the stock held by them, including their contracts for the sale of stock sold for account of the railroad company, which could not be delivered on demand. It is the 306,000 shares of stock so acquired which are now to be turned over to the Atlantic Coast Line.

Under the terms of sale the Atlantic Coast Line assumes $1,400,000 interest on the $35,000,000 bonds to be issued, besides the $480,000 dividends payable on $12,000,000 Atlantic Coast Line Railroad common stock, the disbursement being now at the rate of 4 per cent. It is not necessary to follow here the details of the operations by which, through the railroad company's relations with its controlling corporation, the Atlantic Coast Line Company of Connecticut, the latter company, instead of turning over these bonds and stocks to J. P. Morgan & Co., contract to deliver the $35,000,000 in bonds, $5,000,000 in Atlantic Coast Line Railroad stock and $10,000,000 in cash. The charge to the Atlantic Coast Line Railroad under the plan is the interest and dividends on $35,000,000 bonds and $12,000,000 stock, or $1,880,000, and it will receive on its holdings of $30,600,000 Louisville & Nashville Railroad stock an income of $1,530,000 under the present 5 per cent. dividend rate. This difference of $350,000 would be practically all wiped out were Louisville & Nashville to pay 6 per cent. It is not known that it is proposed to do this, although the Louisville & Nashville Railroad in the 12 months to June 30, 1902, earned a balance of approximately 7¾ per cent. on its present outstanding capital stock, $5,000,000 of which had been issued only in the closing weeks of the fiscal year. Of course the value of the control of this great railroad to the Atlantic Coast Line may be regarded as worth much more than the difference of $350,000 between the yearly outgo and direct cash receipts on the operation.

Thus the plan for the final disposition of the Louisville & Nashville Railroad, turning the control of that great property over to the Atlantic Coast Line, creates another great railroad power, ranking high in mileage controlled, in earning power, in the financial stability of the corporation and in power over the rate-making system in a great section of the country. The rise of this system to influence and power has been one of the remarkable incidents of the recent era of consolidation and re-arranging. The Atlantic Coast Line Railroad a few years ago was merely a collection of half-a-dozen or more relatively unknown lines in Virginia and North and South Carolina, chiefly controlled by Mr. Henry Walters, of Baltimore.

Observing the great development of the Southern Railway and the organization of the Seaboard Air Line Railway, Mr. Walters turned his attention to consolidating his properties and the result was the merger under the Atlantic Coast Line Railroad Company, which on June 30, 1901, operated 1,756 miles of road and in that fiscal year reported gross receipts of $7,915,100 and net earnings of $2,938,271, with $62,916 additional miscellaneous income. The expansion of the system really began this year, when the control of the Savannah, Florida & Western and the other Plant Line railroads, owning and controlling about 2,234 miles, was quietly acquired. This made the Atlantic Coast Line a through system in the South, instead of a collection of lines chiefly serving local territory. Thus consolidated, the company operated through lines from Richmond and Norfolk to Jacksonville and Tampa and most of the important cities between these terminals. It also had its own line to Montgomery, Ala., and Augusta, and a connection with Atlanta through a half interest with the Louisville & Nashville in the lease of the Georgia Railway connecting Augusta and Atlanta. It owns also a one-sixth interest in the Richmond-Washington Company, so that virtually its system begins at Washington. This gave the company control of 3,590 miles of road and entitled it to rank as one of the larger railroad systems of the country. With the Louisville & Nashville the management controls about 8,900 miles of railroad earning in the 12 months to June 30 last $47,705,000 gross. The Atlantic Coast Line Railroad, operating the Louisville & Nashville Railroad, shares control with the Southern Railway of the territory south of the Potomac and Ohio rivers and east of the Mississippi River except in the sections reached by the Norfolk & Western, the Chesapeake & Ohio and the Baltimore & Ohio, which as east and west systems, are not interested in the class of traffic moved by the Southern Railway and the Atlantic Coast Line.

There are two Atlantic Coast Line companies with securities outstanding in the hands of the public. The Atlantic Coast Line Railroad is the operating company and the latest available reports show common stock authorized for $42,000,000 and $18,850,000 5 per cent. preferred stock. A majority, however, of each class of stock is held by the Atlantic Coast Line Company of Connecticut, which is a security holding company and has in its treasury a large amount of other securities of the railroads in the Atlantic Coast Line system. It is this company which will hold control of the Louisville & Nashville, just as it holds control of the Atlantic Coast Line Railroad. Its outstanding capital stock, however, is only $10,000,000, paying now 8 per cent. dividends. This rate was only established this year.

As showing the earning power of the new system, the following figures may be given showing the gross and net earnings in the 12 months to June 30 in each of the last two fiscal years for the Atlantic Coast Line Railroad as existing a year ago; for the Savannah, Florida & West-

ern, now consolidated with the property, and also for the Louisville & Nashville, which is hereafter to be operated by the Atlantic Coast Line:

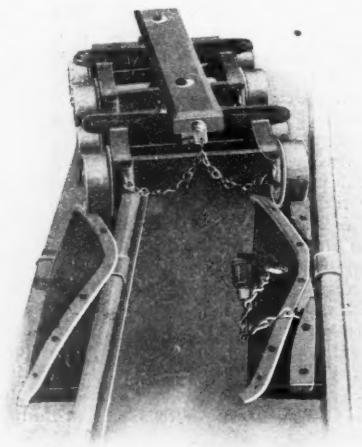
Gross Earnings.	1902.	1901.	Increase.
Atlantic Coast Line...	$8,549,526	$7,915,100	$634,426
Savannah, Fla. & W'n.	8,475,505	7,948,368	527,137
Total	$17,025,031	$15,863,468	$1,161,563
Add Louisville & Nash.	$30,680,100	28,022,207	2,657,893
Total all lines.....	$47,705,131	$43,885,675	$3,819,456
Net Earnings.			
Atlantic Coast Line...	$3,450,539	$2,938,270	$512,269
Savannah, Fla. & W'n..	2,752,578	2,466,161	286,417
Total	$6,203,117	$5,404,431	$798,686
Add Louisville & Nash.	9,769,840	9,789,180	*19,340
Total all lines.....	$15,972,957	$15,193,611	$779,346

*Decrease.

The new Prussian Minister of Public Works has issued instructions emphasizing the duty of all officials to see not only that their subordinates know the rules and regulations of their branch of the service when they are first admitted to it; but that they habitually follow and obey them. Especially must this be done with all who have to do with matters pertaining to the safety of trains, as signalmen, switchmen and trainmen, permanent or temporarily. Even the *Railroad Gazette* has not insisted more strongly on such disciplinary measures than the Prussian Minister of Public Works; and doubtless both he and ourselves will find it necessary to repeat our admonitions to the end of our respective careers. Just now, this piece of intelligence comes in appositely with a remark made by Mr. C. R. Barnes in his comments on the management of the electric railroads of the State of New York. They require their men to learn the rules when they enter the service, says Mr. Barnes, but at any time thereafter the investigator finds that the knowledge has largely evaporated. In several other matters, by the way, Mr. Barnes gives testimony which confirms things that we have said in recent articles holding up the conduct of the electric roads as examples, to steam roads and all roads, of what should *not* be done. It does not appear that any of our strictures have been at all excessive in their severity. On the other hand, the electric railroad manager who feels that every man's hand is against him, if such there be, may temporarily comfort himself with the thought that the Germans—who, it appears, are having to learn some of the same lessons that are up for discussion here—have been running railroads 60 or 70 years. No electric road has yet had one-fourth of that time in which to correct its faults. And there are steam railroad officers in America as well as in Germany who have thus far seemed to think that catechising experienced trainmen is wholly unnecessary. Nevertheless, the new railroad manager, whether his motors are electric or something else, will do well to heed Mr. Barnes.

The Walker Car Replacer.

A new device for replacing derailed cars or locomotives is shown in the accompanying engraving. The illustration is taken from a small model of truck and frogs which was on exhibition at the Roadmasters' and Maintenance of Way Convention at Milwaukee, Wis., and which attracted considerable attention among the track men, the ease with which the truck model was re-railed from almost any conceivable position being a matter of comment.



The Walker Car Replacer.

The device is made of machinery steel and oak wood, the latter being used as a filling. The inside replacer is made of a $^{5}/_{16}$-in. steel plate rectangular in plan and cambered at the middle to a height sufficient to throw the wheel on the rail. It is 8 in. wide and 3 ft. 4 in. long before forming and is cold-riveted to a ¼-in. rectangular flat steel plate on the bottom 3 ft. 6 in. long and 6 in. wide; the wood filling comes between these two plates. The runs on top of the upper plate are made of 1¾-in. square metal, cold-riveted to the plate. There are also guide pieces at each end riveted to the plate in the same manner. The outside replacer is similar in construction, except that the camber is 1 in. higher in order to carry the flanges over the top of the rail, and the guide pieces are omitted; also the runs are 1½x2 in.

The replacers are held to the rail by flat steel clamps, ¾x7 in. in section, which hook over the rail and are tightened by means of a tapered key on the opposite side of the replacer, plainly seen in the engraving. A metal guide wedge, for blocking the opposite run from that in which the wheel is to run, is chained to the inside replacer, its object being to avoid any possibility of the flange being diverted into the run it blocks. The bottom plate of each frog is provided with four sharp brads which imbed themselves in the ties, preventing slipping; it is claimed that unfavorable weather conditions, such as an ice-coated track, do not interfere with the satisfactory service of the device.

One particular advantage claimed for the Walker replacer is that the number of cars that can be replaced with one adjustment of the frogs is limited only by the power to haul them. This is due to the fact that wheels on the track will pass the attached frogs without disturbance, thus avoiding stopping, replacing the frogs and starting up for each set of derailed wheels. All wheels within 10 in. of the rail will be carried on without further attention. If the distance exceeds this, a piece of T rail set workways and at an angle, one end resting in the run of the inside replacer and the other against the opposite rail, will deflect the wheels in the desired direction. If a very heavy car or a locomotive requires this additional provision it is well to spike the rail to the ties. We understand that this simple feature of using the piece of T rail in conjunction with a replacer in the manner described is patented with these devices.

If derailment is desired it may readily be accomplished, by use of the outside replacer only, in the reverse position from that used as a re-railer. The weight per pair of the replacers is 260 lbs.; they are made adjustable to fit any size of rail.

The Walker Car Replacer Co., St. Paul, Minn. (Mr. F. C. Towns, President), is the maker.

New Plant of the American Steel Castings Company.

The new plant of the American Steel Castings Company at Alliance, Ohio, is laid out to provide for five 10-ton furnaces, 50-foot centers, and arranged so that the first two can be put into operation without interfering with the old ones.

The furnace building is 70 ft. wide and 40 ft. high, with a 10-ton crane spanning the whole building and serving the charging floor and stock yard. An electric charging machine is also provided with trolley wires beneath the platform. The gas producers are in a separate building about 40 ft. from the furnace building. Herein are ten 10 ft. gas producers, water sealed. Each furnace has a stack 100 ft. high and 5 ft. in diameter.

The stack house and charging room are all under one span and are served by one crane. The charging platform reaches to within 24 ft. of the side of the building and allows room for double tracks, each being 270 ft. long and accommodating 14 to 16 cars at once. This arrangement reduces the cost of handling the stock.

The open hearth building is a steel frame structure with steel trusses and purlins covered with pine and slate.

Each furnace has a capacity of 20 to 25 tons. The hearth is 21 ft. long and 9 ft. 8 in. wide, the highest point being 8 ft. 7 in. from the steel work. The parts are 5 ft. 4½ in. long, being twice as long as those of any other plant of the company. Each port has 2 uptakes from the gas regenerator and 3 from the air regenerator, each 13½ x 27 in. Each gas uptake connects to its own flue. The 3 air uptakes enter into one chamber 10 ft. wide and 1 ft. 3 in. high. Each furnace has 3 charging doors in front, each door being operated by an hydraulic cylinder. No doors are placed in the tapping side.

The regenerators for each furnace consist of 1 for air 9 ft. 1 in. wide, and 2 for gas, each 8 ft. 1 in. wide. All are 12 ft. 10 in. long and 13 ft. 1 in. high. The checkers are 10 ft. deep, having about 90 cu. ft. of checkers per ton of steel.

The gas producers are 10 ft. in diameter inside the shell and 14 ft. 10½ in. high from bottom of pan to top of water cooled plate. The blowers are the Eynon-Evans make and the air is forced through a cast-iron cone grate in the center of the producers, which is built up of cast-iron rings with ⅜ in. air openings between them. The main advantages of these producers are as follows:

1. Water cooled top, thus keeping the platform more comfortable for the men. 2. Water sealed base. 3. The ashes can be removed from a producer from any point in its circumference. 4. The cone grate spreads the blast very equally throughout the coal, forming better combustion and making more gas. 5. Each producer is provided with a soot valve so that it can be cut off from the main flue without leakage. 6. The door in this soot valve casing allows the cleaning of the plate flue between the producer and the soot valve.

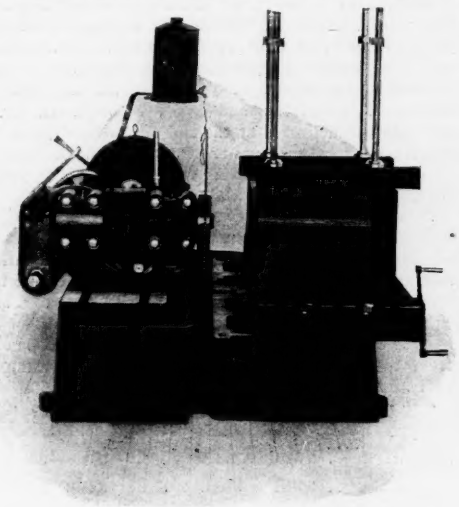
The new plant was built by the Riter-Conley Manufacturing Company. The notes are from a long article in the *Iron Age*.

The French railroads have been introducing larger cars. The Northern Railroad already has more than 10,000 of 20 tons (44,000 lbs.) capacity, devoted chiefly to carrying coal, coke, and sugar; it has also some 25-ton cars for timber and iron, and it is reported that it will build some to carry 40 and 50 tons.

A New Metal Sawing Machine.

The accompanying illustrations show one of the latest metal sawing machines made by the Q & C Company. Machines of this type have recently been installed in the new shops of the Lake Shore & Michigan Southern at Collinwood, and by the Chicago City Railroad Co., to be used principally for frog and switch work, but they are also suitable for a wide range of work on structural shapes, plates and bars.

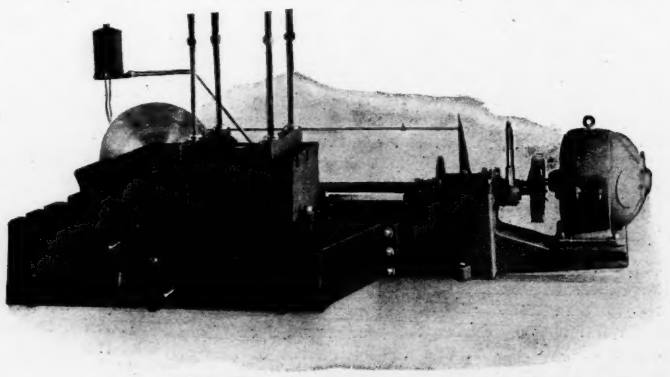
The machine consists of a heavy bed, saw carriage, feeding and driving mechanism and two work tables that are fitted to the bed. The work is bolted to either of these tables and is cut off by the motion of the saw and carriage being fed into it. The saw is 27 in. in diameter, fine tooth, of the arbor driven type, and has a longitudinal travel of 30 in., giving it a capacity for cutting I beams up to 15 in. in a vertical position and 8 in. rounds. The arbor is of extra large diameter, of crucible steel and the pinion on this arbor is formed solid with it. The worm



End View, Q & C Co.'s Metal Saw.

wheel shaft on which the driving pinion is also formed solid, is of hardened crucible steel, the worm being of hardened steel and the worm wheel of phosphor bronze.

The machine is fitted with the Q & C Company's latest type of friction feed, giving an automatic feed variable from $^{3}/_{16}$ in. to $^{15}/_{16}$ in. per minute. The feed is applied to the feed screw through a crown clutch which in one position engages with the automatic feed and in another position by friction, engages the feed screw with a train of gears, giving a quick return movement to the carriage by power. The lever shown in the engraving actuates this clutch and by means of a rod passing through a lug on the carriage, forms an automatic stop to the saw in both directions. When this clutch is out of gear the carriage can be moved in either direction.



Side View, Q & C Co.'s Metal Saw.

A feature of interest is the way in which the entire travel of the saw blade is made available for cutting off work on the top side table, while at the same time, rounds or squares up to 8 in. can be cut off in a V block provided for this purpose at the front end of the table. The side table is in two parts, the lower portion movable longitudinally upon the base and the upper portion movable transversely upon the lower portion of it. This transverse movement is for the purpose of adjusting the work with relation to the saw blades after it has been clamped into position, so as to be able to cut off the work at exactly the desired point without undue time being taken to accurately secure it on the table.

When the lower table is in extreme forward position the saw blade can cut off work on the upper side table through the entire range of its travel. By moving this table backwards, the V block is brought within range of the saw blade so that by this method a greater capacity is obtained for a given length of saw travel than is possible in the ordinary construction.

The Mersey Tunnel Railroad.

We have noted more than once the fact of the electrifying of the Mersey Tunnel railroad. We take the following notes from a long report of the last half-yearly general meeting of the Mersey Tunnel Company, which was recently held in London. In moving the adoption of

the report and statement of accounts, the Chairman said:

"The reason for the falling off in the receipts is the competition of the Birkenhead electric tramways, which has for the first time had full effect in this half-year as compared with the tunnel worked by steam locomotives. Everywhere, I think, where that competition has taken place it has been found that steam locomotion in tunnels goes to the wall and the electrical tramway gets the traffic. The Mersey Railway Company cannot hope with steam underground to compete with electrical tramways on the service. According to the view of the board, and I think of everyone who has considered the problem, the hope of the Mersey Railway Company lies in giving the best possible service to the public of Liverpool and Birkenhead for getting from one place to the other by electrical traction. The contract which we have made with the British Westinghouse Company has that for its purpose. If our tunnel serves the purpose which it is designed to serve, the more abundant the tramways on both sides the better it will be for us. As regards the construction of the works, I am glad to be able to report that they are being proceeded with energetically by the Westinghouse Company. There is every reason to believe that when we next meet in this room to consider the half-yearly accounts of the company the traffic will be carried on by electrical traction under the new conditions. The contract date is Jan. 15, and if by that time we have a fairly good service working practically and smoothly, we will be satisfied with the contractors."

Warped Ends for Concrete Arch Culverts.

BY DANIEL B. LUTEN.*

Stone is being superseded by concrete so rapidly as the favorite material for culverts that it is not surprising to find engineers using the new material in the same way as the old, without much consideration of the superior adaptability of concrete. For example, it is quite the usual thing to see wing walls of concrete with the upper inclined surface stepped as in stone walls; to find the base of a small wing of uniform width from end to end; and not infrequently to find the wing set back from the springing point as if to avoid the ring stones. The arch ring of the culvert is frequently designed according to rough empirical rules, such as those given by Trautwine for stone arches, resulting in a clumsy, awkward section that is far from efficient when concrete is the material used. It is not difficult to devise a more efficient section for a concrete arch than the full-centered type usually used for arches of stone. Since the material of the ring costs no more than that of the walls, the height of the abutments may be decreased and the span increased; if the waterway remains the same, the latter form will discharge a greater amount of water in a given time, and will require less material. Arches of three or five centers are a nearer approximation to the curve of equilibrium for the given loading in most cases, than arches of semi-circular or segmental form, and the former are not more expensive to build than the latter, and require less material with greater discharge capacity. In short, the design of an arch ring of concrete offers a much wider field for the display of originality, and for investigation both from theoretical and practical standpoints, than does one of stone.

The same is true in a lesser degree, of the wings and parapets, or other forms of inlet or outlet to the arch proper. A wing wall may be finished at its upper surface as shown in Fig. 1, with a plane surface parallel to

Fig. 1.—Concrete Arch Near Acton, Ind.—C., C., C. & St. L.

the side slope, and of uniform width, with less expense for forms and labor and the same amount of material, than by the method of forming the surface into steps. The wing walls thus finished also present a much more finished, stable, and handsome appearance. The face of the wing should be battered in a uniform plane, passing through the springing point of the arch. The pavement laid across the bed of the stream to render the structure flood-proof, if extended to the ends of the wings, will act as a strut to prevent sliding as well as overturning of the wings, which may consequently be designed of lighter section than otherwise. These details of design were observed in the construction of bridge 448, of the Chicago Division of the Cleveland, Cincinnati, Chicago & St. Louis, near Acton, Ind., shown in photograph in Fig. 1, and in elevation and plan in Fig. 2.

The writer has supervised the erection of several concrete arches the past year, in four of which wings and parapets were omitted, the arch ring being finished in the so-called warped end style, which may be of sufficient interest to warrant a description, together with the reasons for its adoption.

The wing walls and spandrel parapet of Fig. 1, constitute a structure essentially different from the main barrel of the arch of which it forms the end. They do not expand and contract in the same way as the arch ring, under extremes of temperature; since their principal function is to act as retaining walls for the earth embankment, they must consist of heavy masses to resist overturning; the arch ring may, by careful consideration of the principles of equilibrium, be reduced to a minimum of thickness and maximum of efficiency with a considerable degree of certainty, but the wings and parapet must remain heavy masses of masonry on account of the uncertainties attending the design of retaining walls. As a consequence, cracks due to unequal expansion or contraction, to unequal settlement, or to varying conditions of stress under the loading, are apt to occur. Such cracks, while they are not as apt to appear in concrete as in a similar structure of stone, and are no more indicative of failure than in a stone structure, are very unsightly, and are to be avoided if possible.

The wing walls serve also to deflect the stream, and for this purpose are usually splayed about 30 deg. with the center line of the stream; for efficiency of discharge, an angle of 10 or 15 deg. would probably be better and would be less liable to become clogged by floating debris. If the stream have a reasonably permanent channel, the form of wing shown in Fig. 2, parallel to the stream, or slightly splayed, requires the least material and is efficient. The warped end is a modification of this latter case, and is designed to save the excess of material required for the retaining walls, and to avoid the dangers

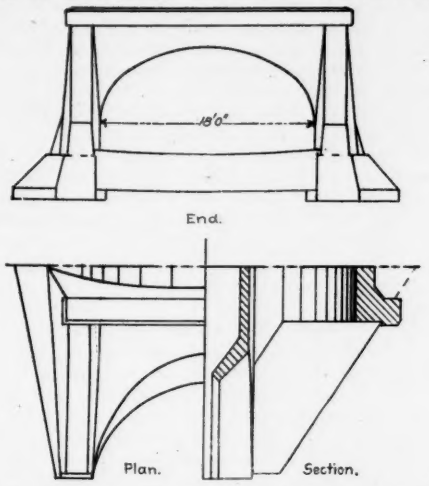


Fig. 2.—Plan and Elevation of Concrete Arch Near Acton, Ind.—C., C., C. & St. L.

of cracking from unequal distortion, but with no considerations for appearance. Two of the arches with warped ends are shown in Fig. 3 and Fig. 4.

The arch ring of these structures is produced to meet the side slope of the embankment, and is cut by a plane parallel to the plane of the side slope and a few inches above it. The face of the end is moulded to a warped surface generated by a right line remaining approximately normal to the interior surface of the arch barrel, and moving so as to form a surface of nearly uniform width between the plane of the side slope and the intrados of the arch. A shoulder is moulded above this face, to hold the toe of the embankment where it rests upon the arch ring. Such a form of end construction is not feasible in a stone arch, but in a concrete structure saves a considerable amount of material over the wing and parapet type; the arch ring and the ends being of uniform construction throughout, there is much less liability of cracking, and of the ends separating from the rest of the arch; although the warped end requires more skill in laying out, it requires less labor and lumber in the preparation of the forms.

Figure 4 represents Bridge 60, St. Louis Division, Cleveland, Cincinnati, Chicago & St. Louis near Hadley, Ind., the concrete arch replacing an iron structure. This arch is of 20 ft. span and 9 ft. opening, being practically of the same form and dimensions for the arch rib as the arch of Figs. 1 and 2, which is of 18 ft. span and 9 ft. opening. A comparison of the methods of construction of these two arches, together with the bills of labor and materials actually required in the ends of each, will show with considerable accuracy the relative cost of the two types of ends, under average conditions.

In erecting the forms for the wings and spandrel of Fig. 1, the lagging of the drum was sawed off squarely the forms for the face of the wing erected with the upper line cut to a slope of one and one-half to one, and capped with a 2 x 4 edge-board. The lumber required for this part of the forms, and for the box of the coping was 2-in. No. 1 hemlock, dressed and matched. Lumber for the back of wings and back of spandrel was 1-in. green hardwood. The base of the wing was made equal in width to one-third the height, being 4 ft. 6 in. at the widest point for an extreme height of 14 ft. The spandrel wall was 2 ft. thick at the top, increasing to 3 ft. at the lowest point. The cubical contents of the end constructed with wings and spandrel, and including 3 ft. of the end of the arch ring, is 66½ cu. yds.

In the arch with warped end, the centers and lagging of the drum were continued to the end of the wings at the sides, the lagging being partially omitted on the crown. A warped surface was built up of ⅞-in. flooring, tapered and placed radially, against which the concrete was tamped. A few hours later this warped form would be removed and the warped face of the concrete trowelled, the warped form in the meantime being carried in two sections to the other end of the arch, and placed for the other face. The proper position for the warped form is easily determined by stretching two lines in the plane of the side slope, and measuring a constant distance from the plane of the two lines normal to the drum of the arch.

Fig. 3.—Small Cattle Pass with Warped Ends—Indianapolis & Martinsville Rapid Transit Ry.

The additional lumber required for the warped end of Fig. 3, assuming the length of the end to be the same as for the arch with wings, was slightly less than for the facing of the wings and spandrel, and the labor required for its erection was only one-fourth as much. The cubical contents of the warped end, including the arch ring to the same distance from the ends of the wings as in the other case, is 44 cu. yds.

Comparison of the bills of materials and labor for the two types of ends, omitting excavation which would be the same in each, is as follows:

Wing and Spandrel.

Lumber for forms estimated at 50 per cent. of first cost.		
600 board ft. 2 x 8, D. & M., at	$16.00	
300 board ft. 2 x 24 bracing, at	14.00	
200 board ft. 1-in. hardwood, at	12.00	
Total lumber		$8.10
Erection		9.50
Concrete, 66½ yds		332.50
		$350.10

Warped End.

475 board ft. 2 x 6, at	$15.00	
2 additional centers, at	1.75	
120 board ft. hardwood, at	12.00	
Total lumber		$5.68
Erection		2.30
Concrete, 44 yds.		220.00
		$227.98

The difference in favor of the warped end is $122.12. This would mean a saving of nearly $25 in the cost of the arch, or about 15 per cent. of the cost of such a structure as that shown in Fig. 1, in which the length of barrel is about 30 ft. The warped end arch would require a slightly greater amount of fill, amounting in the given case to about 7 cu. yds. But the principal point to be emphasized by this comparison is the fact that the warped end can be built with less material, and less labor and lumber for forms. As to the ability of foremen to lay out this type of end, it is as easily acquired as the proper arrangement of forms for wings with the face bat-

Fig. 4.—Concrete Arch with Warped Ends Near Hadley, Ind.—C., C., C. & St. L.

tered and passing through the springing point of the arch, which is by no means a simple problem for the average foreman or carpenter.

The arch shown in Fig. 3 is a small cattle pass on the Indianapolis & Martinsville Rapid Transit Ry. The span is 4 ft. and the opening is 6 ft., with warped ends, which resulted in a saving of about 20 per cent. over the wing and spandrel type.

Of course the whole argument for this type of end construction rests upon the question of cost and utility; in appearance it bears no comparison to the wings and spandrel, and is, in fact, almost ugly, as the photographs readily show. It has its uses, however, for locations on railroads and electric lines, where appearance is a matter secondary to first cost and utility.

The Germans have completed the 2 ft. gage railroad in their Southwestern African possession from the coast at Swakopmund northeast 250 miles to Windhoek, which is 5,363 ft. above sea level. For the greater part of the distance the country is barren; but near the terminus it is fertile and well wooded. There is one train each way weekly, which takes two days to run the 250 miles, waiting over night at a station. The road has been built by a detachment of railroad troops.

*President, The National Bridge Company, Indianapolis, Ind.

TECHNICAL

Manufacturing and Business.

The Barber truck, sold by the Standard Car Truck Co., Chicago, was specified on 3,475 cars during the month of September.

Increased orders from leading roads have justified the American Frog & Switch Co., of Hamilton, Ohio, in putting on a large night force.

The Structural Steel Supply Co. has filed articles of incorporation in Newark, N. J., with an authorized capital of $750,000. C. M. Gilpin and E. E. Robinson are incorporators.

The American Car & Truck Co., of St. Louis, has been incorporated in Missouri to build street railroad cars and trucks. The capital stock is $1,000,000. G. Martin Brill, of Philadelphia, is the principal stockholder.

W. G. A. Millar, formerly Manager of the Ornamental Department of the American Bridge Company, has been appointed Purchasing Agent of that company, with offices at No. 259 South Fourth street, Philadelphia, Pa.

F. M. Pease (Incorporated) has just finished a new car building plant at Hegewisch, Ill., and is prepared to build all descriptions of freight equipment. The daily capacity is 20 cars and at present there is very little work on hand, so arrangements can be made for prompt delivery of several hundred cars.

The Sterlingworth Railway Supply Co. has appointed M. P. Kelly Western Sales Agent, with headquarters in Great Northern Building, Chicago, succeeding Geo. C. Murray, resigned. Fred C. Cameron is appointed Eastern Sales Agent, with headquarters at Philadelphia. Mr. Cameron has been Selling Agent for several years of the Brady Metal Co.

Last week, in referring to the Barnett Equipment Co. of America, we stated that it was the purpose of the concern to make a device to control street railroad cars. We are now informed that the company will make and sell an automatic device designed to take the place of ordinary safety chains on railroad cars. Stephen D. Barnett, President, is the patentee.

The Pneumatic Signal Company announces that, beginning Oct. 1, the company's Chicago office will be in charge of Mr. George E. Ellis, Signal Engineer and Western Agent, succeeding Mr. S. T. Rowley, resigned. Mr. Ellis has had an important position with the company in its eastern territory for some years, and before that was Assistant Engineer on the New York Central.

At a meeting of the Board of Directors of the Chicago Pneumatic Tool Co., Sept. 24, a quarterly dividend of 2 per cent. was declared, payable Oct. 15. The capital stock of the company is $10,000,000. An appropriation was made to enlarge the Detroit plant, which addition will increase the company's capacity one-third. This plant and also the air compressor works at Franklin, Pa., are running night and day.

The Kennicott Water Softener Co. announces that as a result of the increasing demand for its water softeners it has decided to bring the business directly under its own supervision and has withdrawn the agency from the J. S. Toppan Co., heretofore the railroad sales agents. A railroad department has been inaugurated under the personal supervision of Mr. Wm. R. Toppan and all communications should be addressed to the Kennicott Water Softener Co., Railroad Department, Chicago. The company also announces that 16 of its softeners, with capacities ranging from 4,000 to 20,000 gals. per hour, are under construction for railroads.

The new plant of the Niles Car & Manufacturing Co., at Niles, Ohio, is busy in all departments. The company has increased its capital stock by $100,000, new machinery has been put in and the facilities largely increased. In the erecting and finishing shops are 10 Seaboard Air Line passenger coaches, 61 ft. long, enclosed Pullman type of vestibule, with standard steel platforms; 20 heavy 45 ft. suburban coaches for the Western Ohio Traction Co.; 45 Detroit United Railway Company cars with 28 ft. bodies; 10 Toledo Power & Light Co. cars. There have just been shipped six handsome cars for the Railroad Construction Co., of Philadelphia, for use in New Brunswick.

The Crocker-Wheeler Co. holds at its works, annually, a convention of its branch managers, the object of which is to bring into closer relations representatives of the company and at the same time give them a chance to compare notes and perfect plans for handling business. This year's meeting took place Sept. 25 and 26. On the evening of the first day a banquet, attended also by the officers of the company, was given at the Engineers' Club, New York, at which Putnam A. Bates, General Sales Manager and also Assistant Secretary of the company, was presented with a cut glass spirit set. The presentation speech was made by Francis B. De Grass, manager of the New York office and senior branch manager in point of service.

Iron and Steel.

The Philadelphia Steel & Iron Co. has been organized with $1,000,000 capital to take over the Ferro-Carbon Casting Co.

At a meeting of the directors of the United States Steel Co. in Everett, Mass., last week, Chas. S. Miller was elected President and Treasurer, and H. B. Whall, Vice-President.

A Railroad Supply Combination.

Despatches from Chicago tell us of a great combination going on amongst railroad supply houses, looking towards a so-called trust, with $40,000,000 capital. The names of about 16 important houses are mentioned as having been formally asked to join the combination. No doubt something is going on, but it would be entirely premature to attempt to say what is going on or who is in it.

The Benson Switch Lamp Burner.

Mr. F. V. Benson's switch lamp burner is now in use on over 5,000 switches on the Atchison, Topeka & Santa Fe, and is being introduced on a number of other roads. The business of making these lamps is now in the hands of the Coffin-Megeath Supply Co., of Franklin, Pa. The device has a special wick, which does not have to be cut oftener than once a month, and the lamp burns only about 10 gallons of oil a year when going night and day, or less than two ounces each 12 hours. The flame is ¾-in. high. Numerous tests have shown that the lamps will burn over six days without re-filling and the regular practice where they are used is to fill and trim the lamps only once in every five days. The manufacturers estimate that this saving in the cost of attendance amounts to nearly $5 per lamp per year. There is a pin in the wick tube, holding the wick in position, so that the light cannot be extinguished by jarring.

Pneumatic Tool Litigation.

Judge Lacombe, of the United States Circuit Court, on Sept. 24, granted a restraining order, upon application of the Chicago Pneumatic Tool Co., restraining the Philadelphia Pneumatic Tool Co., in the Southern District of New York and until further order of the Court, from making, selling or using drills in infringement of the Moffet patent owned by the Chicago Pneumatic Tool Co. An injunction had previously been issued against the Franklin Boiler Works, of Troy, N. Y., a user of one of the infringing drills made by the Philadelphia Pneumatic Tool Co., but the latter company claimed that, as this injunction was not against it directly, it was at liberty to continue to make and sell such drills. The defendants were required to appear before Judge Lacombe Oct. 1 and show cause why a permanent injunction should not issue against them. No decision had been rendered at time of going to press. As indicated above, the order of Judge Lacombe applies to the Southern District of New York only.

Steel Cars as Steel Consumers.

In *The Iron Trade Review* appears an estimate of the magnitude of the steel car industry for the year 1903. With the growth of the industry during the last five years and the improvements now under way as a basis, the probable output of the Pressed Steel Car Co. is placed at 48,000 cars, and the total production for the year, including the output of the smaller companies, is estimated at between 60,000 and 65,000 cars. Orders in hand and the increasing need of new and heavy equipment seem to justify these figures. The consumption of steel and iron for this large number of cars will tax the steel mills. The consumption of plates alone will amount to more than 500,000 tons, or five times the output of one modern plate mill. An equal weight of steel and iron forgings and castings will be used. With these figures in mind the possibilities of the steel car industry as a feeder in the iron and steel trade can be appreciated.

Street Railroads.

The August issue of the *Journal of the Association of Engineering Societies* contains a series of articles on street railroads, written by various members of the Boston Society of Civil Engineers. These papers, with the discussion, fill 70 pages, and cover a variety of topics. The *Journal* may be had by addressing Mr. John C. Trautwine, Jr., 257 South Fourth street, Philadelphia, Pa. The price is 30 cents a copy.

Portland Cement Output.

The report of James M. Clark, Chief of the Bureau of Industrial Statistics of the Department of Internal Affairs, on the production of Portland cement in Pennsylvania, shows that about 13,000,000 barrels were consumed in the United States in 1901; that 12,711,225 barrels of this consumption were home production, and that of this production Pennsylvania made 6,873,203 barrels. The production in Pennsylvania for 1901 had a market value at the works of $7,334,891.

Moving Stairs for the Subway, New York.

The Otis Elevator Company has recently closed a contract with the Subway Construction Company for an escalator, or moving stairway, to be installed at the Manhattan Street Station of the new Rapid Transit road. At this point, the line crosses the Manhattan valley on a viaduct, the tracks being about 40 ft. above the level of the street. The escalator will carry passengers both up and down, the two tracks being arranged in the same vertical plane. The guaranteed carrying capacity of the device is 20,000 people per hour, 10,000 in each direction. A motor of 35 horse-power will be sufficient to operate the mechanism when working at its maximum capacity.

Electrical Pile Driver.

In a recent issue of the London *Engineer* appeared a description of an electric pile driver. The weight or "monkey," as it is called, has its top face planed so that an electro magnet can attach itself. The magnet has a lifting capacity of three tons and is controlled from the winding platform. The method of operation is as follows: The electro magnet is brought in contact with the "monkey" and the current turned on. The motor is then started and the weight lifted. When the proper height has been reached the current is shut off to the magnet and the weight drops. The same switch that cuts off the current to the magnet also controls a right and left-handed magnetic coil clutch so that the change from lifting the weight to lowering the electro magnet is quickly and easily made. The motor is also used to propel the entire apparatus.

The Steel Corporation Decision.

Justice Van Sickel, of the Court of Errors and Appeals, New Jersey, filed a written opinion on the 26th in the United States Steel Corporation case that was recently decided in the corporation's favor. The case before the court was the suit instituted by Mrs. Miriam Berger. The opinion filed now sustains the constitutionality of the Act of last winter under which the corporation undertook to convert $200,000,000 worth of preferred stock into a like amount of bonds. The opinion also holds that the procedure followed by the corporation carrying out the conversion plan was fully authorized by the General Corporation Act. The full text of the memorandum opinion follows:

"The decree of the Court of Chancery in this case is reversed and the injunction dissolved. This Court holds that the method adopted by the Board of Directors and approved by a two-thirds vote of stockholders for retiring preferred stock is authorized by the Corporation Act of 1896 and is a lawful exercise of the granted power. The Court further holds that the Act of 1902 is constitutional and that the scheme for retirement of stock adopted by the defendant company is also a lawful exercise of the authority granted in that Act. I am instructed by the Court to make the above announcement because other cases are now pending in the Court of Chancery in which the same questions are litigated. I will file the opinion of the Court, stating the reasons upon which the decision of the Court is based, as soon as I have time to prepare it."

The Simplon Tunnel.

The work on the Simplon Tunnel is progressing more favorably. The progress on the south end, which was almost stopped for nine months by the vein of water tapped, is now more rapid than on the north end, where unexpectedly high temperatures have been encountered, reaching at one place 126 deg. Fahr. But for the peculiar ventilating arrangement provided by the side tunnel, this probably would have put a stop to the work altogether. The latest report is that the temperature of the rock at the heading is less. In July the penetration advanced at the rate of 23 ft. 4 in. per day at the south end and 16 ft. 9 in. at the north end, and the total penetration, 1,229 ft., was greater than in any previous month. At the end of July the total penetration was 41,133 ft. or more than 7¾ miles. About three-fifths of this was at the north end.

New York City Bridges.

A great deal of money is being spent in New York City for new bridges. The total cost of the bridges now building and authorized will be more than $52,000,000. The following is a list of some of those under construction or for which bids will be wanted soon:

The East River, No. 3, between the boroughs of Manhattan and Brooklyn (Manhattan Bridge), $16,000,000; building.

East River, No. 4, between the boroughs of Manhattan and Queens (Blackwell's Island Bridge), $12,500,000; building.

East River, No. 2, between Manhattan and Brooklyn (Williamsburg Bridge), $19,500,000; building.

Harlem River, between 145th and 149th streets, $2,500,000; building.

Bronx River at Westchester avenue, $100,000; building.

Bronx River at 177th street or Tremont avenue, borough of the Bronx; bids soon wanted.

Newtown Creek from Grand street, borough of Brooklyn, to Grand street, borough of Queens, $230,000; about finished.

East Chester Bay, Pelham Bay Park; probable cost $350,000.

New York & Harlem Railroad at 153d street, the Bronx, $150,000; building.

Newtown Creek between Manhattan and Vernon avenues, Brooklyn, $1,000,000; building.

Gowanus Canal at Ninth street, borough of Brooklyn, $50,000; authorized.

Gowanus Canal at Third street; authorized.

Gowanus Canal at Union street, probable cost $50,000; contract probably to be let in November.

Gowanus Canal at Hamilton avenue, borough of Brooklyn; probable cost $160,000.

Gerritson's Creek at Avenue U, borough of Brooklyn, $16,000; building.

Dutch Kills at Borden avenue, borough of Queens; contract to be let pretty soon.

New Navy Dry Dock.

All proposals submitted for the construction of the concrete and granite dry dock "No. 3" at the Norfolk Navy Yard have been rejected by the Navy Department, as the bids opened were all high and complicated. Some changes will be made in the specifications, and the work will be readvertised for. (July 25, p. 596.)

THE SCRAP HEAP.

Notes.

The passenger train cars of the Fremont, Elkhorn & Missouri Valley are to be painted yellow, and this color is to be adopted for the passenger cars of all railroads in the Chicago & North Western system.

Press despatches from New Orleans this week report the whole of the street car lines of the city tied up by a strike, 1,800 men having stopped work on the refusal of their demand for shorter hours and higher pay.

The office of the superintendent of dining cars of the Louisville & Nashville has been moved to Nashville. The road will soon have enough dining cars to furnish all meals on the three through trains each way between Cincinnati and New Orleans.

The railroad department of the Young Men's Christian Association, at Harrisburg, Pa., has laid the corner stone of a handsome new building to cost $35,000. The Pennsylvania Railroad gave the land and $15,000 in money. The auditorium will seat 800 persons.

According to the *News* of Mansfield, Ohio, the South-

ern Pacific has in Ohio 200 agents, employed in the interest of the Land and Emigration Department of the road, and these agents are to be taken in a special train to Louisiana and Texas for the purpose of seeing the country and to better qualify themselves to present its merits to intending emigrants.

The executive committee of the so-called Interstate Commerce Convention, of which Mr. E. P. Bacon appears to be the leading spirit, announces that it is going to at once begin a campaign for the passage by Congress of some one of the bills which were before that body at its last session enlarging the powers of the Interstate Commerce Commission. The committee held a meeting in Chicago last week, and those who attended reported a general public dissatisfaction over the failure of Congress to take suitable action at its last session.

A Winnipeg correspondent says that the wheat crop of Manitoba this year will be a hundred million bushels, which is much larger than the Department of Agriculture estimated earlier in the season, and is twelve millions more than the crop in 1901. Out of the eighty-eight millions bushels raised last year, twenty-six millions went to Great Britain (more than 2½ times as much as in 1900); as well as over a million barrels of flour. With these rapid increases it is predicted that shipments from Canada will have a marked effect on the prices which can be got for the wheat shipped from the United States and from India.

The Annual Report of the Philadelphia Car Service (Demurrage) Association, which has just been issued, shows that for the year ending Aug. 31 the average detention per car was 1.43 days, substantially the same as last year; number of cars handled 1,625,749 (8.32 per cent. increase over 1901); total collections 31 per cent. increase; net collections 30 per cent. increase; collections per car 6.11 cents; per cent. of expenses, 25.53. This last figure has steadily declined from 74 per cent. in 1891, 61 per cent. in 1897 and 45 per cent. in 1899. The percentage of the total collections which has been refunded has been, beginning with 1898, as follows: 12.26, 9.15, 7.11, 8.60 and, in 1902, 9.34.

The New York, New Haven & Hartford is preparing to stimulate the export of western freight from Boston by making contracts with steamship lines which will provide for regular sailings from the railroad company's South Boston docks. There will be a line at Antwerp, probably touching at Havre, and one to Manchester. Some Boston merchants seem to doubt the possibility of establishing a profitable line to Antwerp, and they say that the feasibility of shipping western grain to Europe by way of New York and Boston (by railroad through to Boston) remains to be proved, though it is to be supposed that the New Haven road, in making this arrangement, is guided in some degree by what it has already done in export freight by this route. Improvements are to be made at the South Boston freight terminals to facilitate the transfer of freight from cars to large vessels.

According to the Fall River *News* the cotton manufacturers of that city have reached an agreement with the New York, New Haven & Hartford Railroad concerning storage rates on cotton. The railroad is to restore through transportation rates from the West, and cotton is to be unloaded on or soon after arrival. According to the *News* the cotton is to be unloaded upon the platforms and the consignees will have four days for removal of the cotton without any charge being made. After four days a charge of 2 cents per bale per day will be made for 10 days, 3 cents per bale per day for the second 10 days; 4 cents per bale per day for the third 10 days. There is no danger that cotton will be allowed to remain on the railroad company's platforms more than 10 days after demurrage charges have begun, as public warehouse charges are only from 8 to 12 cents per bale per month.

The car famine has set in. The most definite and detailed reports come from Tennessee, Alabama and the State of Washington, but the demand for cars appears to be greater than the supply throughout the Central States. The Chicago reporters gather that the railroads east of that city have all the freight they want to fill their cars; but information from other sources would seem to indicate that this is a mild statement of the case, that many shippers have to wait for cars. From the Hocking Valley road in Ohio and from a number of roads in Texas the reports are varied by the statement that locomotives are scarce. In other words, the entire freight facilities of the railroads are taxed to their utmost. On important trunk lines it is said that shipments of perishable freight are from eight to 24 hours behind schedule a good deal of the time, owing to the crowded condition of the yards and the large number of trains moving.

Oil-Car Regulations in Texas.

The Railroad Commissioners of Texas, after protracted hearings and listening to many complaints, have promulgated rules for the movement of oil tank cars. Railroads must receive and promptly transport tank cars of petroleum, and must promptly return empty cars. They must pay to the owners 7½ mills per mile and $1 per car per day for all time over 10 days consumed in a haul of 100 miles; the same rate for all over 15 days for hauls up to 200 miles, and over 20 days if more than 200 miles; but time spent in loading, unloading or repairing is not to be counted. If the railroad has tank cars of its own and offers them, it is not required to pay mileage on cars tendered by shippers. Shippers must apply for cars in writing, and the railroads must supply the cars within six days, without discrimination. No road is required to furnish more than 10 cars at a time to one shipper, nor more than 50 cars in 10 days, nor more than 150 cars in one month. Other detailed rules are given, and a shipper applying for cars must deposit one-fourth of the amount of money necessary to prepay the freight to destination. If the cars are not loaded in 48 hours the railroad may retain the money deposited. These rules go into effect Oct. 13.

The Railway Banks' Floral Association.

This is the name of an association which has been formed in England for promoting the planting of trees and shrubbery on the sides of railroad cuts and embankments and which is described in the September number of *Park and Cemetery* (Chicago). The North-Eastern Railway has expressed its approval of the scheme and anybody who desires to beautify a bank or cutting along the line of that road can have the privilege, by applying to the nearest station master. The secretary of the association is Victoria Grey, but her address is not given. The honorable treasurer is Miss Pease, of Pendower, Newcastle-on-Tyne. She says that a good deal of work has already been done, 10,000 bulbs having been set out in the vicinity of Newcastle and Berwick. She has $300 in the treasury and will be glad to receive additions to her fund. Although, to the American observer, the railroads of England appear to be rich in grass-grown banks and cuttings, the promoters of this association appear to be far from satisfied and they speak of "the 20,000 miles of barren and unattractive cuttings and embankments which disfigure the landscape of Great Britain," and which need the gardener's attention. As this number represents pretty nearly the whole of the railroad mileage of the United Kingdom, the person who made the statement evidently indulged in a bit of exaggeration.

Pig Iron in Canada, First Half of 1902.

The American Iron and Steel Association has received the statistics of the production of pig iron in Canada in the first six months of 1902. The figures show a slight increase as compared with the last half of 1901, but a very great increase as compared with the first half of that year. In the first six months of 1902 the production of all kinds of pig iron in the whole of the Dominion amounted to 157,804 gross tons, as compared with 149,952 tons in the last half of 1901 and 95,024 tons in the first half of the year. The increase in the first half of 1902 over the last half of 1901 was 7,852 tons, or over 5 per cent., while the increase over the first half of 1901 was 62,780 tons, or over 66 per cent. . . . On June 30, 1902, Canada had 14 completed blast furnaces, of which 8 were in blast and 6 were idle. Of this total 9 were equipped to use coke for fuel, 4 to use charcoal, and 1 to use mixed charcoal and coke. In addition three coke and two charcoal furnaces were being built on June 30, 1902, but work upon two of the coke furnaces was temporarily suspended.—*The Bulletin.*

Pressed Steel Cars in Germany.

Under date of Sept. 1, 1902, Consul B. H. Warner, of Leipzig, says: "The directors of the Prussian State railroads have recommended to the Minister of Public Works that a bill be introduced into the Prussian Parliament, providing for the construction of pressed-steel coal cars of 20 tons carrying capacity. The Minister, after giving the matter careful consideration, has suggested that the proposals be somewhat modified, and, as soon as the bill is amended, it is believed that Prussian State railroads will place pressed steel cars in commission.

A Memorial to Andrew Reasoner.

The Andrew Reasoner Memorial Chapel, attached to the Munn Avenue Presbyterian Church, was dedicated at East Orange, N. J., Sept. 28. The chapel, which cost $40,000, is of brownstone. It is the gift of Mrs. Abby Reasoner, widow of Andrew Reasoner, who was Superintendent of the Delaware, Lackawanna & Western Railroad.

An English Railroad Officer in France.

The "Memoirs of Sir Edward Blount, K. C. B., 1815-1902," have lately been published by Longmans, Green & Co., London. Sir Edward was a very important person in the introduction of railroads into France. For long he was the chairman of the Western Line till a clamor was raised by General Mercier against the danger of allowing a foreigner to be in such a position seeing that he would know the plans for mobilization. He was also a director of the P. L. M., and other lines.

The Lake Commission.

The State Department, through the British embassy at Washington, has invited the Canadian Government to name commissioners to co-operate with similar commissioners to be appointed by the Government of the United States, to constitute what is to be known as The Lake Commission. This Commission is to investigate and report upon questions connected with the changes of level of the Great Lakes, including the effect upon lake levels of such works as the Chicago Drainage Canal and the water power works at Sault Ste. Marie, and the desirability of establishing a dam at some point on the lower waters of the lakes as a means of maintaining a uniform level. When the Canadian answer is received the State Department will announce the names of the United States Commissioners, who will be army officers and civil engineers.

Twenty-Six Passengers Killed in France.

Press despatches of September 27 report that an express train ot the Northern Railroad running at high speed was derailed near Douai, France, and 26 persons were killed. The engine was overturned, and the carriages were crushed against it and wrecked. About 50 persons were injured.

LOCOMOTIVE BUILDING.

The Erie is having 10 locomotives built at the Baldwin Works.

The Cincinnati, Richmond & Muncie will shortly be in the market for locomotives.

The Atlantic Coast Line is having four locomotives built at the Baldwin Works.

The Missouri Pacific is having five locomotives built at the Cooke works of the American Locomotive Co.

The Seaboard Air Line is having 10 locomotives built at the Richmond Works of the American Car & Foundry Co.

The Bessemer & Lake Erie is having 10 locomotives built by the American Locomotive Co., in addition to the order reported last spring.

The New York Central & Hudson River is reported to have ordered 90 locomotives for 1903 delivery from the Schenectady Works of the American Locomotive Co.

The Pennsylvania has ordered 32 class E2 and 30 class H6A locomotives from the American Locomotive Co., and 48 H6A locomotives from the Baldwin Works for the Lines West, for 1903 delivery.

The Chicago & North Western has ordered 14 ten-wheel, 10 passenger and six switch engines from the American Locomotive Co., and 45 locomotives from the Baldwin Works, all of which are duplicates of those ordered during the past two or three years.

The West Virginia Central & Pittsburgh has ordered four simple consolidation engines from the Baldwin Locomotive Works for December and January delivery. The engines will weigh 286,000 lbs., with 154,200 lbs. on the drivers, and have 22 x 28 in. cylinders, 51 in. drivers, straight boilers, with a working steam pressure of 190 lbs., a total heating surface of 2,630 sq. ft.; 300 tubes, 2¼ in. outside diameter, 13 ft. 10 in. long; fire-box 125 11/16 in. long and 42⅝ in. wide; a grate area of 37 sq. ft.; tank capacity of 6,000 gallons of water and 10 tons of coal.

The Missouri, Kansas & Texas has ordered from the Baldwin Locomotive Works 10 freight locomotives and 10 passenger locomotives. The freight engines will weigh approximately 129,000 lbs. on drivers, total weight 149,000 lbs.; cylinders, 20 x 28 in.; extended wagon top boilers, with a working pressure of 200 lbs., and radial stay fire-box to be built of carbon steel 101 in. long, 66 in. wide; tubes of charcoal iron 316 in number, diameter 2 in., length 12 ft. 8 in.; grate area 46.7 sq. ft.; driving wheels, 63 in. diameter; journals 9 x 12 in.; driving wheel base of 15 ft. The passenger engines will weigh approximately 143,000 lbs.; weight on drivers approximately 108,000 lbs., extended wagon top boilers, with radial stays and a working pressure of 200 lbs.; carbon steel fire-box 101⅛ in., and 41¼ in. wide; 304 tubes of charcoal iron 14 ft. 6½ in. long and 2 in. wide; heating surface of fire-box 171 sq. ft.; grate area 30.97 sq. ft.; diameter of driving wheels 72 in.; driving wheel base 13 ft. 6 in.

The Seaboard Air Line order for 41 simple consolidation and 10-wheel engines to be built at the Baldwin Works, reported in our issue of Sept. 12, is as follows: The 10-wheel engines will weigh 152,500 lbs., on drivers, 120,000 lbs. Cylinders, 20 x 28 in.; drivers, 67 in.; wagon-top boilers with working steam pressure of 200 lbs. Total heating surface, 2,644 sq. ft. Tubes, 332, 14 ft. 1⅛ in. long and 2 in. outside diameter. Fire-box of carbon steel, 108 in. x 42 in. Grate area, 31.5 sq. ft. The consolidations are divided into two classes, with weight on drivers 155,000 lbs. and 129,250 lbs., respectively. The heavier engines have 21 x 30 in. cylinders, 56 in. drivers, wagon-ton boilers, with 200 lbs. working pressure and 2,768 sq. ft. heating surface. Tubes, 332, 15 ft. long and 2 in. outside diameter. Fire-box, 99 in. x 66 in., of carbon steel. Grate area, 53 sq. ft. The smaller engines have 20 x 28 in. cylinders and 56 in. drivers; wagon-top boilers, 200 lbs. pressure, and heating surface of 2,169 sq. ft. Tubes, 269, 14 ft. 5 in. long, and 2 in. outside diameter. Fire-box, 90 x 66 in., of carbon steel. Grate area, 41.25 sq. ft. Special equipment for all three classes of engines includes Westinghouse brakes, machinery steel driving axles and hammered iron or steel truck axles; magnesia sectional boiler lagging, Tower couplers, Monitor No. 10 improved injectors, Ajax journal bearings, U. S. Metallic piston rod and valve rod packing, Coale safety valves, Leach automatic sanding devices, double Nathan sight-feed lubricators, Chas. Scott springs, extra-hard driving wheel tires, and steel truck wheel tires.

CAR BUILDING.

The Grand Trunk is getting prices on ore cars.

The Lake Erie, Alliance & Wheeling is asking prices on 500 40-ton coal cars.

The West Side Belt (Pittsburgh) is asking prices on 1,000 40-ton gondolas.

The Oliver Refrigerating Co. is having 50 freights built at the Erie Car Works.

The Berwind-White Co. is having 40 freights built at the Middletown Car Works.

The Cincinnati, New Orleans & Texas Pacific has ordered seven coaches from Barney & Smith.

The U. S. Leather Co. is having 20 freights built at the Milton Works of the American Car & Foundry Co.

The Eastern Kentucky is having 25 freights built at the Huntington Works of the American Car & Foundry Co.

The Seaboard Air Line has ordered 400 hopper, 200 gondola, 200 flat and 100 coke cars from the American Car & Foundry Co.

The Northern Pacific is having eight coaches built at the Barney & Smith Works, in addition to the order reported in our issue of Sept. 5.

The Chicago, St. Paul, Minneapolis & Omaha is having 10 coaches built at the Pullman Works, in addition to those reported in our issue of Aug. 15.

The Chicago & Eastern Illinois has ordered 250 box and 1,500 flat cars from the American Car & Foundry Co., and 250 box cars from the Mt. Vernon Car Mfg. Co.

The Southern is having 250 freights built at the Barney & Smith Works and 196 by the American Car & Foundry Co., and has ordered two dining cars from the latter.

The Canadian Pacific is figuring on 1,000 flat and 500 coal cars, and is reported in the market for 10 sleeping, two dining and 12 tourist cars and 20 first-class coaches.

The Southern Pacific is asking prices on 1,000 box cars of 80,000 lbs. capacity, with steel underframes; 1,000 flat cars of 80,000 lbs. capacity, with steel underframes; 500 stock cars, with steel underframes; 100 chair cars 60 ft. long, and 75 refrigerator cars.

F. M. Hicks, of the Hicks Locomotive & Car Works, has received orders for passenger cars rebuilt from the Duluth, Missabe & Northern, the St. Louis, Memphis & Southeastern and the Brunswick & Birmingham; also for freight cars rebuilt from five lumber contracting, etc., companies during the past week.

The Bellingham Bay & British Columbia is building 40 flat cars of 60,000 lbs. capacity at its own shops. The cars will weigh 24,000 lbs. and be 41 ft. long and 9 ft. wide, with wooden underframes. The special equipment will include: Leighton & Howard cast-steel bolsters, Westinghouse air-brakes and Tower couplers.

The Pennsylvania, as reported rumored in our issue of Aug. 22, has ordered 12,000 freights from the Pressed Steel Car Co. for 1903 delivery. Seven thousand of these cars are for the Lines East, and 5,000 for the Lines West. The order includes steel gondolas and box cars, and also wooden gondolas with steel underframes, all of 100,000 lbs. capacity.

The Kansas City Southern order reported in our issue of Sept. 19, calls for 75 tank cars of 8,000 gal. capacity, and 25 tank cars of 10,000 gal. capacity, to be built with wooden underframes. Special equipment includes iron axles, American steel bolsters, Kelso couplers, Miner draft rigging, M. C. B. cast-iron journal boxes and jour-

nal box lids, Scott springs, American steel trucks and 33-in. wheels.

The New York Central & Hudson River has ordered 1,000 box cars of 80,000 lbs. capacity from the American Car & Foundry Co. for 1902 delivery, cars to be 36 ft. long inside, 8 ft. 6 in. wide inside, and 8 ft. high inside, to be built of wood with wooden underframes. Special equipment includes N. Y. C. specification axles, cast-steel bolsters, National hollow brake-beams, Lappan brake-shoes, N. Y. C. specification brasses, Gould couplers, Security doors, Gould draft rigging, Harrison dust guards, Gould or McCord journal boxes and journal box lids, Chicago Improved Winslow roofs and Diamond trucks.

BRIDGE BUILDING.

Baltimore, Md.—W. W. Crosby, Road Engineer for the Fifth District of Baltimore, writes that he will receive bids at any time for a steel bridge across George's Run.

Berryville, Va.—The Supervisors are considering the advisability of holding an election to authorize an issue of $40,000 bonds for the proposed bridges over Shenandoah River at Castleman and Berry's ferries.

Big Timber, Mont.—The Board of County Commissioners of Sweet Grass County want bids the first Monday in December for a bridge over Big Grass River at Mydland crossing. J. H. Moore, County Clerk.

Boston, Mass.—The City Engineer will receive bids until Oct. 8 for the steel superstructure of sections A and B of the Broadway bridge.

Brandon, Miss.—Bids are wanted Oct. 6 for a 128-ft. bridge over Dey Creek. G. W. W. White, Clerk.

Cass, Ind.—J. M. Lang, County Auditor, Sullivan, Ind., wants bids Oct. 10 for an iron bridge.

Columbus, Ind.—Bids are wanted Oct. 6 by Samuel W. Fitch, Auditor, for a steel and wooden bridge over Driftwood River to be 523 ft. long.

Council Bluffs, Iowa.—The City Council has amended the ordinance fixing the grade on the extension of the Chicago Great Western into Council Bluffs, by adding a section thereto, requiring the railroad to build an overhead crossing at Garfield avenue, between Woodbury and South avenues.

Elwood, Ind.—Bids are wanted, Oct. 4, by E. Perry, County Auditor, Tipton, for a steel bridge over Polliwog ditch.

Florence, Kan.—Bids are wanted Oct. 9 at 1 p.m., for an iron bridge with stone abutments, to be built over Cottonwood River east of Florence. Address Ira S. Sterling, County Clerk, Marion.

Galena, Ill.—The following highway bridges were authorized at the meeting of the Board of County Supervisors of Joe Davis's County, held two weeks ago: Town of Hanover, two bridges, address J. J. Steele, Blanding; town of Derinda, two bridges, Robt. Irwin, Pleasant Valley; town of Guilford, four bridges, H. Hicks, Scales Mound. The dates for receiving bids have not yet been fixed.

Girard, Kan.—The County Commissioners will open bids on Oct. 14 at the County Clerk's office for building nine bridges in various parts of the county. They will all be of steel and the total cost will approximate $10,000.

Jacksonville, Fla.—Messrs. Hildreth & Co., Consulting Engineers, New York City, are working on the plans for the Bridge street viaduct over the railroad tracks. Including approaches, it will be 1,200 ft. long. A committee will probably be appointed to receive bids.

Joliet, Ill.—The Highway Commissioners and the County Commissioners have agreed to rebuild the Red Mill bridge at a cost of about $14,000.

Lynnville, Ind.—Bids are wanted Oct. 6 by Chas. F. Martin at Newburgh, for a steel bridge over Big Creek.

Los Angeles, Cal.—The San Pedro, Los Angeles & Salt Lake R. R. will soon build a bridge over the Santa Ana River in Los Angeles County, near the city of Los Angeles, to be of concrete arches of eight spans, the total length to be 800 ft.

Moline, Ill.—The Rock Island County Supervisors and the Board of Supervisors of Henry County have decided to build a new bridge over Rock River, but we are told that it is not finally decided where it will be located. The bridge will be about 500 ft. long and cost about $18,000. M. A. Gould, County Surveyor at Moline, may be able to give information.

New South Wales.—Bids are wanted by the Commissioner of Roads and Bridges of New South Wales for building the steel bascule bridge over the Murrumbridgee River, at Darlington Point.

Olivers, Ind.—Bids are wanted Oct. 7 by the Commissioners of Posey County for a bridge over Big Creek.

Oskaloosa, Iowa.—W. T. Martin, County Auditor, will receive bids for a steel bridge 110 ft. long over South Skunk River, which will be opened at the November meeting of the Board of Supervisors.

Robinson, Ill.—Southwest Township and Crawford County are considering building a bridge over Embaras River near Robinson, but we are told no definite arrangements have been made.

Rock Port, Mo.—J. W. Krusor, Road and Bridge Commissioner, will receive bids until Oct. 7 for repairs to 20 bridges, which includes considerable steel work.

St. Joseph, Mo.—The Chicago, Rock Island & Pacific has decided not to build a new bridge over the Missouri River at this place, but has made an agreement with the St. Joseph & Grand Island R. R. to operate over its bridge, which will be rebuilt.

St. Louis, Mo.—A. S. Cunningham, Bridge Engineer of the Wabash R. R., tells us that he will let contracts at once for six plate girder and one pin-connected bridge, the total cost of which will be $35,000.

San Diego, Cal.—We are told that plans have been submitted to the Council for a bridge across the San Diego River, but no action has been taken. Bonds will have to be voted by the people for this and other improvements before bids will be wanted. Geo. A. d'Hemecourt, City Engineer.

Shelbyville, Ind.—The Board of County Commissioners want bids Oct. 18 for a number of steel bridges with stone abutments. Henry Oltman, Auditor.

Somerville, N. J.—The Somerset County Board of Chosen Freeholders last week decided to build three more bridges. They are not very large structures.

Spencer, Ind.—S. M. Kerr, County Auditor, Bloomington, want bids Oct. 18 for a steel bridge over White River between Monroe and Owen Counties, to cost $11,000.

Thomaston, Ga.—Bids are wanted Oct. 13 for a 216 ft. lattice bridge over Flint River. W. B. Adams, Upson, County Commissioner.

Victoria, B. C.—C. H. Topp, City Engineer, wires that the time for receiving bids for the superstructure of the bridge at Point Ellice has been extended until 4 p.m., Oct. 27. The plans and specifications may be seen at this office. The plans are based upon the highway bridge specifications of Theodore Cooper for 1901. It is to consist of four 146 ft. 5 in. through pin-connected spans, and is to accommodate one street railroad track, a highway and two foot-walks.

White Sulphur Springs, Mont.—A highway bridge will be built over Smith River by the County Commissioners, according to report.

Other Structures.

Allegheny, Pa.—See East Liberty, Pa.

Cheswick, Pa.—The Pittsburgh Tool & Drop Forging Co., recently formed with a capital of $100,000 to make track and mining tools and specialties in drop forgings, is building a plant at Cheswick on the West Penn R. R. The officers are W. F. Schleiter, President; W. R. Wray, Treasurer, and Joseph R. Morris, General Manager.

Donora, Pa.—The Union Steel Co. has recently given a contract to the Riter-Conley Mfg. Co., of Pittsburgh, for the steel work for the two big blast furnaces which are to be built in South Donora. The total cost of the improvements being made by the Union Steel Co. will approximate $3,000,000. The foundations for the furnaces have been under way all summer.

Dubuque, Iowa.—The contract for the extension to the roundhouse of the Chicago Great Western in Dubuque will be let within a few weeks by the Engineer. The additional work is estimated to cost $18,000.

Duluth, Minn.—It is said that the Great Northern will further enlarge its ore docks here.

East Liberty, Pa.—The Pennsylvania R. R. has announced that plans are being made for a new passenger station in East Liberty; also that plans are being made for a new station in Allegheny to take the place of the present Fort Wayne and West Penn stations.

Fort Dodge, Iowa.—F. R. Coates, Chief Engineer of the Chicago Great Western, will receive bids Oct. 4 for a brick freight house two stories high at Fort Dodge.

Marshall, Texas.—The Texas Southern Ry. is rebuilding its shops in West Marshall, making them much larger.

Marshalltown, Iowa.—The contract for the brick passenger station for the Chicago Great Western at Marshalltown has been let. It will be 100 x 24 ft.

Milwaukee, Wis.—The Milwaukee plant of the Illinois Steel Co., which is a part of the United States Steel Corporation, is, together with the plant at Chicago and at Joliet, to be improved at a cost of several million dollars.

Pittsburgh, Pa.—The stockholders of the Jones & Laughlins Steel Co. are to meet on Oct. 8 to vote upon a proposition for issuing $10,000,000 of bonds for the purpose of making additions to the plant. It is said that none of the bonds will be offered to the public.

Roanoke, Va.—Local reports say that the Norfolk & Western has bought 150 acres of land at the extreme end of its yards here, which it proposes to enlarge, and spend about $250,000 in building new shops.

Ruston, La.—An officer of the Arkansas Southern writes that work on rebuilding the shops at Ruston which were destroyed early in the spring, will not be begun until next year.

St. Paul, Minn.—A local paper has recently published some particulars about the Great Northern's new shops now building in the Como District, St. Paul. The main machine shop will be 150 x 660 ft. This will adjoin a boiler and machine shop 450 x 425 ft. There will be a storehouse 100 x 200 ft.; also a brass foundry 50 x 100 ft. The power house will be 105 x 112 ft., and will supply electric power for all the machinery in the various shops which are to be run by independent motors. The walls of some of these buildings are already up.

Toledo, Ohio.—The Wheeling & Lake Erie has let contracts for a 10-stall engine house at Toledo at a cost of $10,000, and a steel turn-table to cost $3,500. J. C. Cariand & Co. are doing the earthwork; G. A. Craig the masonry; A. Bentley & Sons the engine house, and the King Bridge Co. will supply the turn-table.

Trenton, N. J.—It is said that the American Bridge Co. has plans made for the improvements to the plant in Trenton.

Wilmington, Del.—It is said that the Philadelphia, Wilmington & Baltimore is receiving bids for additional work on its shops at Shellpot, Del., about two miles from Wilmington. The work, on which bids were received last week, consists of 10 separate buildings, all of steel and brick.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xvi.)

Brotherhood of Locomotive Firemen.

At the annual convention of this brotherhood in Chattanooga, Tenn., Sept. 22, John J. Hannahan was elected Grand Master.

American Institute of Mining Engineers.

The fall meeting of the American Institute of Mining Engineers will be held on Oct. 14 at New Haven, Conn. R. W. Raymond, of New York City, Secretary.

American Society of Civil Engineers.

On Wednesday, Oct. 1, at 8:30 p.m., there was a regular business meeting of the Society, and a paper entitled "The Flow of Water in Wood Pipes," by Theron A. Noble, M. Am. Soc. C. E., was discussed. This paper was printed in the August number of "Proceedings."

Union Brotherhood of Railway Employees.

The organization known by this name, said to be now one year old, boasts of a membership of 25,000 men. A local branch was established at Harrisburg, Pa., on Sept. 23, when an address was given by Vice-President Frank McCabe. The speaker said that the organization was not antagonistic to any other railroad brotherhood. All classes of railroad employees are invited.

American Railway Association

The fall session of the American Railway Association will be held at the Hotel Cadillac, Detroit, Mich., on Wednesday, Oct. 22, 1902, at 11 a.m. Reports will be presented by the following committees: Executive Committee; Committee on Train Rules; Committee on Car Service; Committee on Safety Appliances; Committee on Standard Cipher Code, and Committee on Nominations. Three members of the Committee on Car Service, three members of the Committee on Safety Appliances, and two members of the Committee on Nominations are to be elected.

Pacific Northwest Society of Engineers.

The Pacific Northwest Society of Engineers held its regular monthly meeting at the Chamber of Commerce rooms in Seattle on Saturday evening, Sept. 6. The meeting was presided over by Mr. J. E. Blackwell, Second Vice-President. A paper entitled "Some Remarks on the Teredo and the Limits of its Action" was read by Mr. F. W. D. Holbrook, Civil Engineer, U. S. Navy Department, several specimens of the teredo being exhibited, as well as specimens of lumber and piles showing the action of the teredo. Representatives of a number of pile preserving firms were present and illustrated many methods for preserving piles and lumber and delaying the progress of the teredo. The discussion was participated in by several of the members present.

American Institute of Electrical Engineers.

The 168th meeting was held at 12 West 31st street, Sept. 26; 250 members and guests present. The meeting was called to order by Past-President Steinmetz, who introduced the incoming President, Mr. Charles F. Scott, of Pittsburgh, Pa. President Scott delivered an address on the proposed developments of the Institute, which was listened to with marked attention.

The paper of the evening was then read by Mr. B. G. Lamme on "The Washington, Baltimore & Annapolis Single Phase Railway." The paper was discussed by Messrs. Steinmetz, Mershon, Goldsborough, Arnold, Franklin, Rowland, Mailloux, Gotshall, Wagner and Ries. President Scott in his address, having acknowledged the gift to the Institute of a sum of money for the purchase of various sets of proceedings, a vote of thanks was tendered to Mr. Mailloux on motion of Mr. Steinmetz for his liberality in behalf of the library.

The Engineers' Club of Philadelphia.

A regular meeting of the Club will be held on Oct. 4, at 8 o'clock p.m. The paper will be "Fire Pipe Lines," by John C. Trautwine, Jr. Mr. Carl Hering will make a few remarks on "The Latest and Best Value of the Mechanical Equivalent of Heat," and on "Recent Progress in Single Phase Traction."

Mr. Horatio A. Foster opened a topical discussion on the subject, "Depreciation as Affecting Engineered Structures," at the meeting on Sept. 20, by the reading of a paper in which he set forth some of the usual methods of treating depreciation of engineered structures, plant and equipment, and called attention to some other methods that are less used in this country. His remarks were illustrated by diagrams and tables showing the amounts necessary to set aside at interest as a renewal fund to meet the cost of replacing machines, etc. The general subject was discussed by Messrs. Francis Schumann, Henry J. Hartley, W. C. Furber and others.

The Western Society of Engineers.

Mr. J. H. Warder, Secretary, announces the following papers and addresses for the fall meetings, 1902:

Oct. 1. J. N. Hatch, M. W. S. E., paper on "Modern Handling of Iron Ore on the Great Lakes."

Oct. 15. Messrs. Edward Atkinson and Grey, of Boston, address on "Fire Prevention."

Oct. 22. J. N. Darling, M. W. S. E., paper on "The Yazoo Delta of the Mississippi, and Railroad Locations and Construction There."

E. S. Cole, M. W. S. E., address, "Water Waste in Cities and Its Prevention."

Nov. 5. Elwood Mead, of Washington, D. C., address on "The Administration of Streams Used in Irrigation."

Nov. 19. Fire Chief Musham and City Electrician Ellicott, Chicago, papers describing apparatus and appliances for "Fire Extinguishment in Chicago in 1902."

Dec. 3. J. F. Jackson, M. W. S. E., on "Copper Mining in Upper Michigan."

Dec. 17. A. A. Schenck, M. W. S. E., "Diversity of Engineering Methods on American Railways."

Jan. 6, 1903. Annual meeting, with reports, election of officers and annual dinner.

American Railway Engineering and Maintenance of Way Association.

The year's campaign of this enterprising body is well under way. Below are notes of the recent doings of two of the committees:

A meeting of the Committee on Roadway was held on Sept. 22 in Chicago; present, W. McNab, Chairman; C. Dougherty, Vice-Chairman; W. F. Tye, Canadian Pacific, Montreal; H. J. Slifer, C. & N. W. Ry., Boone, Ia.; Prof. C. Frank Allen, Boston; Prof. W. D. Pence, Purdue, Lafayette, Ind. The general plan to be followed, as outlined in the Board's communication to the Chairman, dated June 12, as well as in the circular issued by the Board to the members in general, dated July, 1902, was discussed. The Chairman submitted a scheme for work in connection with the prospective general report as desired by the Board, which was endorsed by the Committee. The following arrangement for work was decided upon:

1. Historical—Professors Allen and Pence. Evolution in the methods and appliances used in connection with grading, as well as in the forms of specifications for track work for excavations and embankments and kindred works.
2. Analytical—Mr. H. J. Slifer. A comprehensive statement of the necessity for uniformity in definitions and in the use of terms, and the analyzing of the main features that make a good specification.
3. Definitions of Terms—Messrs. C. Dougherty, Hadley Baldwin, A. C. Dennis, R. C. Barnard. A list of terms pertaining to classification of material, names of appliances, and expressions used in connection with work. The formation of the Glossary in concise and explicit terms.
4. Specifications—W. McNab, W. F. Tye, H. C. Phillips. A specification to meet modern ideas under all conditions of earth work, and adaptable to all methods of handling same.
5. Conclusions for recommendation to the Association—W. McNab.

At a meeting of Committee No. 9, Signs, Fences, Crossings and Cattle-Guards, Sept. 25, at Chicago, there were present A. S. Baldwin, Chairman, and T. L. Hanley. The following general plan for the work was adopted, in conformity with the circular letter of instructions from the Board of Direction:

Historical Development—E. G. Ericson and C. H. Ewing. *Fences*—Original forms and purpose; evolution; application to railroad purposes. *Cattle Guards*—Origin, evolution and development.

Fences: Definitions of Terms and Specifications—T. L. Hanley and J. B. Flanders. Glossary of names of parts; requirements for different kinds of stock; as to efficiency, durability, ease of erection and maintenance; standards of various railroads; patented fences.

Cattle Guards: Definitions and Specifications—F. H. Alfred and F. C. Stimson. Definitions of terms; glossary of names of parts; requirements for a perfect guard as to efficiency in turning stock of all kinds and safety and economy of maintenance both as to guard and track; standards; patented devices; location of guard wing and side fences, particularly with reference to line fences on skew crossings of public roads; comparative merits of pit and surface cattle-guards.

Revision—A. S. Baldwin, Chairman, and E. G. Ericson, Vice-Chairman. Conclusions with recommendations to be submitted by the committee as a whole after joint meeting of all sub-committees.

PERSONAL.

—Mr. S. T. Wellman, President of the Wellman-Seaver-Morgan Engineering Company, of Cleveland, has just returned from a three months trip to Europe. Mr. Wellman attended the meeting of the British Iron & Steel Institute at Düsseldorf and also visited the Krupp works and other large steel works.

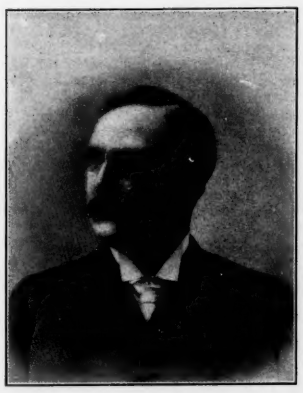
—Mr. Bernard Demmer, Manager of the Vienna Locomotive Works at Floridsdorf since its beginning in 1869, died July 29 last. Demmer's father was a smith, and the son learned the trade with him, but afterwards followed engineering studies in Vienna and began his career as a draftsman. He was associated with Haswell & Engerth in designing some of their well-known locomotives. Under his management the Vienna Locomotive Works completed 1,502 locomotives.

—Mr. W. F. Kiesel, Jr., who on Sept. 11 last succeeded Mr. Gibbs as Assistant Mechanical Engineer of the Pennsylvania, was born in 1866. He received the degree of M. E. from the Lehigh University in 1887. The following year (1888) he entered the service of the Pennsylvania Railroad Company as a draftsman in the office of the Mechanical Engineer at Altoona, later being advanced to the position of chief draftsman. When Mr. Lindstrom left the company to go with the Chicago & Alton in 1900, Mr. Kiesel was promoted to succeed him as Assistant Engineer of Motive Power.

—Mr. H. T. Bentley, the new Assistant Superintendent of Motive Power and Machinery, of the Chicago & North Western, was born in London, England, June 4, 1862. From 1877 to 1892 he was connected with the London & North Western. In October, 1892, he became a machinist on the Chicago & North Western and has been with this company ever since. In June, 1895, he was transferred to Belle Plaine, Iowa, as Division Foreman. Three years later he was made General Foreman; after serving in that capacity for seven months he was made Master Mechanic at Baraboo, Wis., and in January, 1900, was appointed Master Mechanic at Clinton, which position he held until September first this year, when he was appointed to his new position as above stated.

—Mr. W. H. Williams, who recently became Assistant to the General Manager of the Baltimore & Ohio, was born at Athens, Ohio, June 25, 1874. Mr. Williams' first railroad service was with the Pennsylvania Lines at Toledo in 1890, when he began as Assistant Cashier in the local freight office, but resigned from this position to take a business college course. In the fall of 1891 he went with the Pittsburgh & Lake Erie, and in February the following year (1892) became stenographer in the office of the Superintendent of Telegraph on the Pennsylvania Lines at Pittsburgh, being promoted to a similar position in the office of the General Manager the same year. In 1893, he became file clerk and three years afterwards was appointed Secretary to the General Manager and in January, 1901, became chief clerk to the Fourth Vice-President. Six months later he was appointed Assistant Secretary of the Baltimore & Ohio, and in September, 1902, assumed his new duties as Assistant to the General Manager.

—Mr. John F. Wallace, Assistant General Manager of the Illinois Central since January, 1901, has been made General Manager of that company. Mr. Wallace's connection with the Illinois Central dates from 1891, at which time he entered the company's service as Engineer of Construction. A year later he became Chief Engineer, which office he held until July, 1897, when he retired from railroad service to take the position of Vice-President and General Manager of the Mathieson Alkali Works at Providence, R. I. He resumed his connection with the Illinois Central Jan. 1, 1898, as Assistant Second Vice-President, and on Jan. 1, 1901, became Assistant General Manager. Mr. Wallace's professional career has been for the most part in railroad service, having begun in 1869 in the civil engineering department. For five years (1871-1876) he was in the employ of the Engineer Bureau of the War Department, and for three years (1876-1879) in private engineering practice. He has attained well-merited distinction in railroad service, having had charge of many important and well-known projects, including terminal improvements at Chicago and New Orleans. His ability, energy and enterprise have given him a professional place quite apart from that usually reached in the administration of railroads. He was President of the American Society of Civil Engineers in 1900, the year of the visit of that society to Europe. He had already served a term as Vice-President. He was one of the organizers of the American Railway Engineering and Maintenance of Way Association, and served two terms as President of that body. He has also served as President of the Western Society of Engineers. When he went to the Mathieson Company, we expressed our regret that he should leave the railroad service, and we have always thought it fortunate that he returned. His appreciation of the changes in the railroad art, physical, social and economical, has kept him abreast of the forward movement, and we shall be surprised if he does not make a deep mark in the history of the Illinois Central.



ELECTIONS AND APPOINTMENTS.

Baltimore & Ohio.—George F. May has been appointed Assistant Secretary, with office at Baltimore, Md., succeeding Mr. Williams, appointed Assistant to the General Manager.

Brooklyn Rapid Transit.—W. W. Wheatley, Superintendent of the surface lines, and his Assistant, W. B. Yearance, have resigned, effective Oct. 1. Until further notice the duties performed by Mr. Wheatley will be assumed by the General Superintendent.

Central of New Jersey.—C. E. Chambers has been appointed Master Mechanic of the New Jersey Central Division, succeeding J. McGie, resigned. The office of General Road Foreman of Engines has been abolished, effective Oct. 1.

Chesapeake Western.—M. L. Mardis, Superintendent and Traffic Manager, has assumed the duties of General Freight and Passenger Agent, formerly discharged by A. S. Weisiger.

Chicago & North Western.—W. H. Whalen has been appointed Division Superintendent at Boone, Iowa, succeeding H. J. Slifer, and H. W. Battin succeeds Mr. Whalen as Division Superintendent at Fond du Lac. (See Chicago, Rock Island & Pacific.)

Chicago, Rock Island & Pacific.—W. M. Hobbs has been appointed Assistant to the General Manager. H. J. Slifer, heretofore Division Superintendent of the Chicago & North Western, has been appointed General Superintendent of the Eastern District of the C., R. I. & P., with headquarters at Chicago, Ill., succeeding Mr. Hobbs. A. T. Abbott has been appointed Division Superintendent at Colorado Springs, Colo., succeeding F. C. Smith. D. Burleigh succeeds Mr. Abbott as Division Superintendent at Fairbury, Neb.

Chicago Terminal Transfer.—F. W. Peck has been appointed Signal Engineer.

Cincinnati, Indianapolis & Western.—I. F. White has been appointed Superintendent of Tracks and Structures in charge of Maintenance of Way, with headquarters at Hamilton, Ohio. E. Wysong becomes Superintendent of Bridges and Buildings at Connersville, Ind.

Denver, Northwestern & Pacific.—A. C. Ridgway, heretofore General Manager of the Colorado Springs & Cripple Creek District, has been appointed Vice-President and General Manager of the D. N. W. & P., with headquarters at Denver, Colo.

El Paso & Southwestern.—A. L. Hawley has been appointed Auditor, with headquarters at El Paso, Texas, effective Oct. 1.

Erie.—M. P. Blauvelt has been appointed Auditor of this company and the New York, Susquehanna & Western, succeeding J. T. Wann, assigned to other duties, effective Oct. 1.

Gulf, Beaumont & Kansas City.—B. K. Hawkins, Master Mechanic, with headquarters at Beaumont, Texas, has resigned to take a similar position with the Gulf, Colorado & Santa Fe.

Gulf, Colorado & Santa Fe.—See Gulf, Beaumont & Kansas City.

Hudson Valley.—B. S. Josselyn, heretofore Manager of the Kentucky & Indiana Bridge, has been appointed General Manager of the H. V., with headquarters at Glens Falls, N. Y.

Illinois Central.—J. F. Wallace has been appointed General Manager at Chicago. The Assistant General Manager, General Superintendent of Transportation, Assistant General Superintendent, Superintendent of Telegraph, Chief Surgeon, Chief Claim Agent and Chief Special Agent will report to the General Manager. H. U. Wallace, heretofore Division Superintendent at Freeport, Ill., has been appointed Chief Engineer, succeeding W. J. Harahan, who has become Assistant General Manager, succeeding J. F. Wallace. The jurisdiction of Mr. Harahan, J. F. Wallace and H. U. Wallace extends over the Yazoo & Mississippi Valley. J. G. Neudorfer, heretofore Master Mechanic at Water Valley, Miss., has been appointed Superintendent of the Mississippi Division of the I. C., with headquarters at Water Valley, Miss., succeeding A. Philbrick. Mr. Philbrick becomes Superintendent of the Louisville Division at Louisville, Ky., succeeding J. C. Dailey, and Mr. Dailey in turn becomes Superintendent of the Freeport Division at Freeport, Ill., succeeding H. U. Wallace. The following appointments have been made in the mechanical department: A. J. McKillop, Master Mechanic at Mattoon, Ill., succeeding Isaac Rova, who becomes Master Mechanic at East St. Louis, Ill., succeeding R. W. Bell; R. W. Bell becomes Master Mechanic at Waterloo, Iowa, succeeding G. W. Smith, who has been appointed Traveling Assistant Superintendent of Machinery, with headquarters at Chicago. This latter is a newly-created position.

Intercolonial.—J. E. Muhlfeld, Superintendent of Rolling Stock and Machinery, with headquarters at Moncton, N. B., has resigned.

Lehigh Valley.—A. A. Read, Jr., has been appointed Supervisor, with headquarters at Delano, Pa.

Mexican National Construction.—H. P. Webb, Jr., Superintendent of the Zacatecas Division at Zacatecas, Mex., has resigned.

Missouri, Kansas & Texas.—J. W. Walton, Superintendent, has taken charge of the Shreveport and Mineola Divisions and McKinney Branch, with headquarters at Greenville, Texas.

Missouri Pacific.—A. S. Grant, Master Mechanic at Baring Cross, has been transferred to Sedalia; A. Harrity, Master Mechanic at De Soto, has been transferred to Baring Cross, and S. P. Weller, Master Mechanic at Sedalia, has been transferred to De Soto. W. R. Wright has been appointed Superintendent of Little Rock Terminals, with headquarters at Fort Smith Crossing, Ark., succeeding R. H. Dwyer, transferred.

W. J. McKee has been appointed Superintendent, with headquarters at Sedalia, Mo., succeeding George T. Ross, resigned. I. H. Luke, Superintendent at Sedalia, has been appointed to succeed Mr. McKee at Pueblo, Colo., effective Oct. 1.

New York, Susquehanna & Western.—See Erie.

Philadelphia & Reading.—C. Graham has been appointed Division Master Mechanic, with headquarters at Philadelphia, Pa., succeeding J. S. Clampitt, resigned.

St. Louis & San Francisco.—T. S. Reilly has been appointed Master Mechanic of the Southwestern Division, with headquarters at Sapulpa, Ind. T., succeeding L. H. Waugh, resigned, to take effect at once.

Seaboard Air Line.—F. K. Huger, heretofore Division Superintendent of the Southern at Charleston, S. C., has been appointed Superintendent of the Second Division of the S. A. L., with headquarters at Raleigh, N. C., succeeding D. H. Barger, resigned.

Southern.—J. F. Sheahan has been appointed Master Mechanic, with headquarters at Columbia, S. C., succeeding C. F. Thomas, who has taken a position with the American Locomotive Company. S. R. Richards succeeds Mr. Sheahan as Master Mechanic at Selma, Ala., and Mr. Richards is succeeded as Master Mechanic at Lawrenceville, Va., by J. J. Bayley.

F. K. Huger, Division Superintendent, with headquarters at Charleston, S. C., has resigned. (See Seaboard Air Line.)

Southern California.—A. B. Todd has been appointed Division Master Mechanic, with headquarters at San Bernardino, succeeding S. T. Park, resigned.

The Yazoo & Mississippi Valley.—See Illinois Central.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARKANSAS, MISSOURI & KANSAS.—Surveys are reported practically completed for this projected line from Memphis, Tenn., through Joplin, Mo., and west to Chanute, Kan. The company was incorporated in July, 1901, and surveys were begun about a year ago. It is said that contracts will be let at once. Albert N. Hoxie and W. D. Spooner, of Boston, may be addressed. Mr. Spooner is Chief Engineer. (May 23, p. 385.)

BATON ROUGE, OPELOUSAS & WESTERN.—Arrangements are reported being made to build this proposed line in Louisiana. A railroad was partly built between the points named some years ago, but it is understood that engineers have advised against using the former route and that a more direct line will be made. The distance from Baton Rouge to Opelousas is about 55 miles. Mayor Wm. Welch, of Alexandria, La., is interested.

BALTIMORE & OHIO.—Plans are reported filed for an extension of the West Virginia & Pittsburgh Division, to be 20 miles long, in West Virginia.

BENNINGTON & HOOSICK VALLEY (ELECTRIC).—This company will, it is said, build three extensions in the near future, from Troy by way of the Hoosick Valley to North Hoosick, N. Y., 26 miles; from Hoosick Falls through the Hoosick Valley to Williamstown, and from the main line at Eagle Bridge by way of Cambridge to Greenwich. The total length of the system will be 72 miles, when completed, passing through 34 cities, towns, villages, etc., and connecting with the Hudson Valley United Traction, Albany & Hudson and the other electric lines centering about Troy and Albany. The company has for several years worked a line 16½ miles long between Bennington and Hoosick Falls. Geo. E. Greene, Hoosick Falls, N. Y., is President.

BLUEFIELD-CAMP CREEK (ELECTRIC).—It is proposed to build an electric line between these points in West Virginia by way of Princeton, a distance of 17 miles. Dr. S. W. Smith, of Bluefield, W. Va., may be addressed.

BRITISH COLUMBIA ROADS.—Surveys are reported to locate a feasible route from Cowichan, on the Esquimault & Nanaimo, to Alberni, B. C., by way of the Mitinat Valley, a distance of about 80 miles. D. R. Harris, C. E., is in charge of the work. A route to Alberni from Wellington, by way of Cameron Lake, is also being surveyed in the interest of the Government, and it is expected that it will be located in October. Frank Shepherd, of Nanaimo, B. C., is in charge.

CALIFORNIA MIDLAND.—Preliminary surveys for this line, which is to run between Bakersfield, Cal., and the coast at a point near the northern boundary line of Santa Barbara County, have been completed. The projected distance is about 60 miles. It is thought likely that work will be begun at once. The purpose of the promoters was to provide a direct line of transportation from Bakersfield to Tidewater as an outlet for the oil produce of the Kern County district. (May 16, p. 372.)

CANADIAN TRANS-CONTINENTAL.—Announcement is reported made by Colonel Church, of London, Eng., the promoter, that capital to build this projected line from a point near Quebec to Port Simpson, B. C., has been secured and that work will be begun at once on the Saguenay end. The projected line parallels the Canadian Pacific, but runs a considerable distance north.

CANE BELT.—An officer writes in regard to the projected extension from Lane City by way of Damon to Thompson, Texas, 42 miles, for which surveys have been made, that the surveys were merely preliminary and there is no intention of building at present. (Sept. 12, p. 715.)

COLUMBIA RIVER & NORTHERN.—Work on the grade between Washington, Lyle and Goldendale is reported completed for 25 miles out of the entire 42 miles of line, and it is said that track laying will begin soon. Contract was let last May for the first 15 miles between Goldendale and Swale Canyon to Axtell Anderson. A line of steamers is to be run in connection with the road between Portland and The Dalles on the Columbia River. The steamer route is about 140 miles and the rail division 45 miles. Part of the rails which were ordered in Germany have arrived. Rufus Mallory, Portland, Ore., is President. (May 16, p. 372.)

CRIPPLE CREEK & PUEBLO.—Articles of incorporation were filed in Colorado, Sept. 29, to build between the points named, with the eventual intention of extending to other parts of the State. The proposed distance is about 50 miles and the directors are: T. B. Casey, F. W. Hunton, and others, of Boston; John T. McCauley, of Chicago, and C. W. Spurgeon, of Colorado Springs.

CHICAGO, ROCK ISLAND & PACIFIC.—Further details in regard to the new line from Versailles, Mo., to Kansas City, indicate that the contract just let to the W. R. Stubbs Co. is for grading from Versailles to the Big Blue River at Kansas City, a distance of 125 miles. The contract for the grading from the Big Blue River to the city limits has not yet been let. When completed this will be the shortest line between Kansas City and St. Louis. The work involves three tunnels, one of which will be 2,000 ft. long, and a large amount of heavy work. (Sept. 26, p. 749.)

CINCINNATI, HAMILTON & DAYTON.—Surveys are reported for an extension from Gallia Furnace through the Waterloo coal fields to Marion, Lawrence County, Ohio, a distance of about 15 miles. It is proposed to eventually continue the line down Symmes Creek to Rockwood, opposite Huntington, W. Va.

CROWS NEST SOUTHERN.—This new line in British Columbia was opened Sept. 15 between Morrissey Station and Jennings, on the Great Northern, a distance of about 115 miles, connecting the coal mines of the Crows Nest Pass Coal Company by a direct route with the Great Northern. The road is said to be built in substantial shape.

DANVILLE & WESTERN.—It is said that this road, which runs between Danville and Stuart, Va., about 75 miles, will complete the widening of its gage in the near future, although it is not known just when work will be begun. At present the line is standard gage for 43 miles from Danville to Martinsville, and narrow gage from Martinsville to Stuart, 32 miles. J. A. White, Danville, Va., is Superintendent.

DENVER & RIO GRANDE.—Surveys are reported for the new line between Denver and Colorado Springs, and an officer is quoted as saying that if the surveyors succeed in establishing a one per cent. grade from Castle Rock to Palmer Lake and from Palmer to Husted, the line

will be built at once. The present distance over the Denver & Rio Grande is 75 miles.

An officer writes that it is not the company's intention at the present time to extend the proposed line from Salina, on the Rio Grande Western, to a point connecting with the main line near Green River, Utah, beyond the first 20 miles out of Salina. This portion of the line is now building.

Des Moines Southern.—Surveys have been completed for this line from a connection with the Chicago Great Western just south of Des Moines, Iowa, running in a southwestern direction through Winterset to Greenfield, Iowa. Options on the right of way have been secured and taxes in aid of the line have been voted in Winterset, Greenfield and every township west of Winterset. It is expected that work will be begun soon.

Eastern Texas.—An officer writes that approximately 20 miles of extension between Kennard, Houston County, Texas, and Crockett, in the same county, are now being located and contracts will be let after this is completed. The work will involve several bridges, plans for which have not yet been prepared. P. A. McCarthy, Kennard, Houston County, Texas, is Chief Engineer.

Geneva R. R.—Application was made in Alabama, Sept. 22, for permission to sell stock for this projected line from Geneva, in Geneva County, Ala., on the Louisville & Nashville, to Chancellor's, a distance of 11 miles. J. J. Morris, W. W. Barnett, and others, of Geneva, are interested.

Hawkinsville & Florida Southern.—According to most recent advices, the projected extension from the present southern terminus at Worth, Ga., in Worth County, to Bainbridge, in Decatur County, by way of Sylvester and Camilla, will be built soon. The distance is about 90 miles.

Hillsboro-Wortham.—A new line is projected between these points in Texas, 46 miles distant, to run by way of Hubbard. Mass meetings have been held at Hillsboro to raise the necessary funds.

Idaho Roads.—It is said that owners of the Continental mine near Port Hill, on the Kootenai River, Idaho, will build a railroad 16 miles long to connect their properties with the Great Northern. The grades will be as high as 4 per cent.

Illinois Central.—According to most recent advices, options have been secured for the projected branch line from Brookhaven to Monticello, Lawrence County, Miss., a distance of between 25 and 30 miles, and it is proposed to let contracts soon. Grading will probably be begun by November 1. Monticello, the county seat of Geneva County, is at present without railroad facilities. A logging road is now being worked over a considerable portion of the distance to be built, so that not much clearing or grading will be required.

Indian Creek & Pound River.—The first train over this new line in Kentucky from Norton to Cartersville, was run Sept. 24. The road connects with coke works at Cartersville, and will, it is said, be extended into the timber section of Pound Gap, on the Kentucky and Virginia border.

Intercolonial.—General Manager D. Pottinger is calling for tenders to build crib work protection walls at points named in specifications between McKinnon's Harbor and Sydney, Cape Breton, and between Bedford and Rockingham, N. S. Tenders must be sent in by Oct. 6 and specifications can be obtained at the office of the Chief Engineer, Moncton, N. B. The road was inspected by the Minister of Railways last July and a number of changes were planned at that time. (Aug. 1, p. 616.)

Kansas City & Bonner Springs (Electric).—This company has been chartered in Kansas to build an electric road about 23 miles long between the points named. Bonner Springs is important as a railroad junction. It is intended eventually to extend the line. The directors are Edwin Taylor, of Edwardsville, Kan.; John W. Breidenthal, of Kansas City, and others.

Lake Erie, Alliance & Wheeling.—It is said that an extension now being built from Amsterdam to Dillonvale, Ohio, 22 miles, will be completed and in operation by Oct. 15.

Louisville & Nashville.—It is said that a large sum of money will be spent during the coming season on improvements on the Atlanta, Knoxville & Northern, which was acquired by stock purchased last spring. The improvements will chiefly be made between Ducktown, Tenn., and Marietta, Ga., and will consist of reducing grades and putting in steel viaducts and stone culverts. Surveys have already been made for a large part of this work, and it is expected that contract will be let soon.

Ludlow & Southern.—Contract to build this new line from Ludlow, on the Santa Fe Pacific, to Camp Rochester at the mines of the Bagdad Mining & Milling Co., has been let to M. L. Cook, of Los Angeles. (Sept. 5, p. 696.)

Michigan Central Traction.—Work is reported begun on an electric line from Grand Ledge to Charlotte, Mich., a distance of 14 miles.

Paxton, Danville & Wilmington.—This company was incorporated in Illinois, Sept. 24, and proposes to build from Danville to Potomac, Paxton, Wilmington and intermediate points. The incorporators are J. K. Butz and J. W. Dale, of Potomac, Ill., and others.

Phoenix & Eastern.—Right of way is reported secured and it is said that contracts will be let soon to build this projected line from Phoenix to Benson, Ariz., a distance of about 180 miles southeast. It is said that grading will be begun at once. F. M. Murphy, of Phoenix, Ariz., is President, and W. S. Drake Chief Engineer. For map of the projected route see our issue of Feb. 7, page 104.

Ponce Valley & Butte (Electric).—Articles of incorporation for this company were filed in Nebraska, Sept. 17. It is proposed to build from Butte, Neb., to Anoka, on the extension of the Fremont, Elkhorn & Missouri Valley.

San Pedro, Los Angeles & Salt Lake.—Contract for the stretch between Ontario and Riverside, Cal., about 20 miles, has been let to Grant Bros., of Los Angeles. Grading is to be completed by the first of January, at which time about 75 miles of the line will be in operation. (Aug. 29, p. 682.)

Seaboard Air Line.—An officer is quoted as saying that the East & West road, recently acquired by the Seaboard, will be practically rebuilt, the work involving straightening of curves, filling of trestles, etc. Contracts between Coal City and Birmingham are to be let right away. The contracts for work beyond Rockmart, Ga., will be let next month. The East & West of Georgia was incorporated in February, 1901, and was reported as graded last spring, although no track had been laid at that time. (April 18, p. 296.)

Sierra of California.—The branch line from Jamestown to Angel's Camp, Cal., 14 miles, which is under the name of Sierra Valley, has been completed. (June 27, p. 520.)

Southeastern of Yucatan.—According to most recent advices, 10 miles of this projected line from Peto, on the Peninsula of Yucatan, Mexico, by way of Saban and St. Marie to Bahia de la Ascencion, 90 miles, with branches, have been completed. Muller, Schall & Co., of New York, are interested.

Southern Pacific.—It is said that within the next three months trains will be run over several entirely new pieces of road on the main line across Nevada. The new work will begin at Pequop, Nev., and there will be 30 miles of new track laid through the mountains in this vicinity, the cut-off saving 10 miles from the present distance. Between Pequop and Carlin there will be three tunnels which will also shorten the distance, although these will not be completed for use as soon as the other track is. In the Peko Canyon between Elko and Carlin there will be 40 miles of new track, making the line 10 miles shorter, and out of Carlin through Palisade Canyon there will be 20 miles of new track, shortening the line by eight miles. There will also be a long cut-off to Golconda, avoiding the Shoshone curve and leaving Battle Mountain, Stone House and Iron Point to the south. This involves 45 miles of new track and saves 15. Between Browns and Reno there will be 80 miles of new track which reduces grade and curvature rather than distance. This totals a reduction in distance of 43 miles between Lucin and Reno which will be further decreased when the tunnels are finished. The running time will be reduced 3 hrs. and 20 min.

Texas-Mexican (National of Mexico).—Surveys have been begun for a projected extension from Haskell, Texas, to Abilene by way of Anson, a distance of about 162 miles. The line is a part of the National R. R. of Mexico, and runs between Corpus Christi and Laredo. E. H. Tinsley, Civil Engineer, may be addressed at Houston, Texas.

Tilsonburg, Lake Erie & Pacific.—It is said that an extension will be built to Collingwood, Ont., making a connection through from Lake Erie to the Georgian Bay. A line is now completed from Port Burwell to Ingersoll, Ont., and connects with the Wabash, Grand Trunk, Michigan Central and Canadian Pacific lines. John Charlton, M. P., is President.

Toledo, Angola & Western.—A company known as the Toledo, Angola & Western Railway Construction Co. was incorporated Sept. 25 to build this projected line, which proposes to start at once on nine miles of track to connect the glass works at Silica or Glanntown with the Terminal Belt Line of Toledo, and contemplates eventually building about 56 miles additional through Lucas, Fulton and Williams counties, Ohio. Thomas H. Tracy and H. E. King, of Columbus, Ohio, are incorporators of the construction company. (Sept. 5, p. 696.)

Union Traction.—This company has been incorporated to build an electric line from Batavia, Genesee County, N. Y., along the shore of Lake Ontario to Olcott, Niagara County, a distance of about 50 miles. The principal office is located at Medina and the directors are Isadore H. Gavelle, Fred. L. Downs, and others.

Virginia Roads.—Surveys are reported in progress for a new line from Emporia, Va., to a point in Dinwiddie County, a total of about 35 miles, making connections with the Southern, and to be built in the interest of the Brunswick Lumber Co.

Washington & Fayette.—Charter was granted this company in Pennsylvania, Sept. 29, to build a steam railroad nine miles long from a point in the dividing line between the boroughs of Charleroi and Speers, at the mouth of Maple Creek, Washington County, Pa., to a point near Baird Station, crossing the Monongahela River. Harry W. Gleffer, of Pittsburgh, is President.

Western Fayette.—Charter has been granted this company to build from a point in the Borough of Brownsville, Fayette County, Pa., to a point in or near the village of Buffington, in the same county, 10 miles distant. J. M. Milliken, of Allegheny, Pa., is President.

GENERAL RAILROAD NEWS.

Ann Arbor.—The annual statement for the year ending June 30 shows gross earnings of $1,893,410, an increase of $135,262 over the previous year, and operating expenses of $1,222,622, an increase of $63,094. A classification of freight carried during the year shows a decrease in grain and other products of agriculture and an increase in manufactured products. Passenger-miles increased from 15,084,478 in 1901, to 16,425,730, and ton-miles from 191,250,216 to 200,264,691. The ton-miles have considerably more than doubled in the last seven years.

Boston & Maine.—The annual report for the year ending June 30 shows gross earnings of $31,840,694, as against $30,806,838 last year. The total earnings from passenger traffic represented $13,040,502 of this; from freight, $18,732,089; operating expenses were $22,433,151 as against $21,518,785 last year. This includes $3,987,360 maintenance of way and structures, and $2,783,246 maintenance of equipment. Although the freight traffic increased $521,490 during the year, President Tuttle states that the increase would have been much greater except for the marked falling off in the grain exports to Europe during the latter half of the fiscal year, in the carriage of which the company, under normal conditions, profitably participates, and for the temporary cessation of anthracite coal distribution which usually forms a large and valuable portion of the traffic. The cost of labor and of nearly every kind of material and supplies has steadily increased and the otherwise generally satisfactory enlargement in the year's gross income has been largely offset by an almost equal growth in the operating expenses, the greater portion of the increase being due to necessary advances in wages paid employees. In spite of this, however, the road showed a surplus of $1,938,011 of net income over fixed charges of $8,059,433, and from this paid $151,285 on account of the sinking fund, and $1,786,726 in dividends, 6 per cent. being paid on the preferred stock, and 7 per cent. on the common, leaving a balance of $22,367 in excess of all charges and dividends. Several statements are made in regard to the working out of the company's new policy of building short electric lines in different places, and while the results of their operation do not show, as yet, an adequate return upon the capital expenditure, the belief is expressed that the growth of population upon the suburban lines will ultimately add to the present volume of the business enough to make them profitable, particularly from their use as feeders to the steam lines.

At a meeting of the shareholders on Oct. 8 a vote will be taken on the proposition to issue $2,000,000 of bonds and $1,000,000 new common stock, from the proceeds of which $1,300,000 will be devoted to separation of grade crossings, now in progress or ordered; $1,500,000 for new freight equipment, and $1,139,000 for separation of grade crossings and other work already done and for change of grade and other permanent improvements on the Worcester, Nashua & Portland Division.

Canadian Pacific.—The listing of $19,500,000 additional ordinary capital stock, making a total of $84,500,000, has been authorized by the Stock Exchange. This is to provide for new equipment, $9,070,000; reduction of grades, second track, etc., $6,900,000, and enlargement of shop facilities, additional elevators, terminals, sidings, etc., $4,500,000.

Chicago, Burlington & Quincy.—Additional Illinois Division mortgage 3½ per cent. bonds of 1849 have been listed by the New York Stock Exchange to the amount of $10,882,000, making a total of $37,096,000 outstanding. Of the proceeds of these bonds, $3,600,000 was applied to general construction and equipment purposes, and the remainder to the purchase of securities of the Black Hills & Fort Pierre, Davenport, Rock Island & Northwestern, Kansas City & Omaha, Quincy, Omaha & Kansas City, Omaha, Kansas City & Eastern and Kansas City & Northern Connecting Railroads.

Chicago Great Western.—The Stock Exchange has listed additional 4 per cent. debenture stock to the extent of $1,500,000, making a total of $26,327,000, and has authorized the listing of $1,200,000. The proceeds of the entire amount have been or will be applied to changes in grades and other permanent improvements, and for equipment already contracted for during the year. There will be a surplus remaining which will be held for similar expenditures in 1903 and thereafter.

Cincinnati, Lebanon & Northern.—At a special meeting of the stockholders on Oct. 24, the question of an increase in capital stock from $1,000,000 to $1,500,000 will come up. The proposed increase is to cover the cost of the Middletown & Cincinnati R. R., extending from Middletown to Middletown Junction, Ohio, 14 miles, which has recently been taken over. Bonds were issued at the time of the purchase and the stock may, therefore, properly be said to cover the additional value of the property as an asset.

Cuba R. R.—Papers were filed in New Jersey Sept. 18, increasing the capital stock from $500,000 to $20,000,000, of which half is preferred 6 per cent. non-cumulative. The company was incorporated May 1 to build in Cuba from the Bay of Nipe, in the Province of Santiago, to a junction with the railroad of the Cuba Company at or near Alto Cedro, a distance of about 30 miles. It is controlled by the same interests as the Cuba Company (Construction Supplement, March 14, 1902). The incorporators of the Cuba R. R. are Wm. L. Bull, Henry F. Dimock, Franklin B. Lord, Chas. T. Barney and Geo. Crocker.

Mexican Interoceanic.—It is understood that the Mexican Government has bought the majority of the newly created bonds of this company and has thus secured the administration of the property in accordance with the agreement under which the bonds were issued. The price is said to have been a fraction over 90. The bonds bear 4½ per cent., and portion of the reserve fund of Mexico has been applied to their purchase. No official statements as to the future operation of the line have as yet been received, but it is understood that the property is likely to be leased for a period of 50 years to Sir Weetman Pearson & Sons, an English firm which has had dealings of this sort with the Mexican Government before, and owns the street railroad system and harbor works of Vera Cruz, etc.

New Orleans & Northwestern.—This property, which runs from Vidalia across the river from Natchez to Bastrop, 99 miles, was sold at public auction Sept. 21 for $1,750,000. The Mississippi end of the road was sold to E. G. Merriam, of St. Louis, for $250,000, and the Louisiana Division was bought jointly by E. G. Merriam and F. G. Hudson, of Monroe, La., for $1,500,000. Mr. Hudson represents the Missouri Pacific interests.

Pennsylvania.—Purchase is reported of the Pennsylvania Midland, a line partially completed which runs from Cessna to Imler Valley, in Bedford County, Pa., eight miles. The price is said to have been $50,000. The road was begun in 1893 by the late Hon. John Cessna, and is partially built for seven miles beyond its northern terminus to Brooks Mills, where a connection is afforded with the Pennsylvania besides the connection at Cessna.

South Bend & Southern Michigan (Electric).—This company has been consolidated with the South Bend & Northern line to effect a continuous route from South Bend, Ind., to St. Joseph, Mich., a distance of about 33 miles. The capital stock of the consolidated lines is to be $750,000. Alonzo J. Hammond, of South Bend, Ind., is Chief Engineer. (See under Railroad Construction, June 20, p. 486.)

Texas Short Line.—The Texas Railroad Commissioners have approved an application for an issue of $150,000 bonds on the 10-mile stretch between Grand Saline and Hoyt, Texas, which has recently been completed. It is proposed to extend this to Pittsburgh, Texas, 50 miles north, on the line of the St. Louis Southwestern, and other extension also is contemplated. (See under Railroad Construction, Sept. 26, p. 750.)

Union Pacific.—On an increase of 34.1 miles worked, gross receipts for the two months ending Aug. 31 increased from $8,072,288 to $8,525,740. Expenses, including taxes, increased $88,873 in the same period, leaving a balance of $4,190,505 as against $3,825,925 for the same period last year.

Velasco, Brazos & Northern.—Application has been made to the Texas Railroad Commission to register $200,000 on 20 miles of completed railroad between Velasco and Anchor, Texas. The railroad, which is 22 miles long, was transferred on Aug. 7 last to C. C. Waller and E. P. Speers for $240,000, and under the reorganization Mr. Waller was elected President and Mr. Speers Vice-President and General Manager. Preliminary surveys for an extension north were made last spring with the intention, it is said, of building to a point on the Atchison, Topeka & Santa Fe. (Aug. 22, p. 664.)